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University of Montana Bulletin

STATE COLLEGE SERIES—NO. 11.

State College of Agriculture and
Mechanic Arts

ONE AND TWO ROOM RURAL SCHOOL BUILDINGS

by

W. R. PLEW

Prepared for The State Departments of Health
and Public Instruction

BOZEMAN, MONTANA
MARCH 1919.

Entered at Bozeman, Montana, As Second Class Matter Under Act of Congress August 24, 1912.

Montana State University
Bozeman

THE UNIVERSITY OF MONTANA

Edward C. Elliott, Chancellor of the University.

The University of Montana is constituted under the provisions of Chapter 92 of the Laws of the Thirteenth Legislative Assembly, Approved March 14, 1913, (effective July 1, 1913).

The general control and supervision of the University are vested in the State Board of Education. The Chancellor of the University is the chief executive officer. For each of the component institutions there is a local executive board.

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The University comprises the following institutions, schools and departments:

The State University, Missoula

Established February 17, 1893, and consisting of

- The College of Arts and Sciences
- The School of Law
- The School of Pharmacy
- The School of Forestry
- The School of Journalism
- The School of Music
- The School of Business Administration
- The School of Education
- The Summer Quarter
- The Biological Station (Flathead Lake)
- The Public Service Division
- Special War Courses
  - Military Service Course (1 yr.)
  - Nurses' Preparatory Course (1 yr.)
  - Office Training Course (1 yr.)
- The Graduate Division.

Edward O. Sisson, President.

The State College of Agriculture and Mechanic Arts, Bozeman

Established February 16, 1893, and consisting of

- The College of Agriculture
- The College of Engineering
- The College of Applied Science
- The College of Household and Industrial Arts
- Courses in Vocational Education
- The School of Music
- The Summer Quarter
- The Agricultural Experiment Station
- The Agricultural Extension Service
- The Secondary Schools
  - Home Economics
  - Mechanic Arts
  - Agriculture
- Special War Courses
  - Military Service Course (1 yr.)
  - Nurses' Preparatory Course (1 yr.)
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James M. Hamilton, President.

The State School of Mines, Butte

Established February 17, 1893.

Charles H. Bowman, President.

The State Normal College, Dillon

Established February 23, 1893, and consisting of

- The Teachers' Certificate Course
- The Three-years Course
- The Four-years Course
- The Rural Teachers' Course
- The Course for Supervisors

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For publications and detailed information concerning the different schools and college address the President of the particular institution concerned. Communications intended for the Chancellor of the University should be addressed to the State Capitol, Helena, Montana.

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Special
Collections

With the rapid increase of population in Montana and the correspondingly large number of new school buildings being erected each year, it has become imperative that increased attention should be given to the furnishing of plans and specifications particularly for our smaller types of school buildings. It is recommended that trustees desiring to erect larger buildings should employ competent architects who can work out with them personally the details of their needs in regard to capacity of building, lighting, heating, ventilation, sanitation, etc.

For the past two years Mr. W. R. Plew, Professor of Architectural and Civil Engineering at the State College of Agriculture and Mechanic Arts at Bozeman, has prepared plans and specifications for the State Board of Health and State Department of Public Instruction for distribution to school districts desiring to erect one and two-room school buildings. He has also been available for advice and assistance in remodeling smaller school buildings.

It has become evident that the value of his labors would be greatly increased if trustees contemplating the erection of one and two-room school buildings might have the assistance of up-to-date suggestions regarding the best types of buildings and detail directions for their construction, and might also have access to drawings of a number of plans from which to make a selection before calling for plans and specifications from the State Department.

It is, therefore, with a keen sense of the value this bulletin will prove to the school districts of the State, as well as with a deep appreciation of the work of Professor Plew and of his desire to be of service, that the State Department of Education commends this contribution of the State College of Agriculture and Mechanic Arts to the schools of the State.

MAY TRUMPER,
Superintendent of Public Instruction

Helena, Montana
Jan. 15, 1919

FOREWORD

Under the school law of the State of Montana the Secretary of the State Board of Health has been required to furnish suggestive plans for rural school buildings, but it has developed that there is a demand for something more than suggestive plans, i. e., complete detail plans. To meet this demand and to cooperate with him and the State Superintendent of Public Instruction, the department of Architectural Engineering of the University of Montana has undertaken the publication of this bulletin.

The plans and perspective views herein shown are not intended to be used as building plans. Complete blue print plans will be furnished, upon request of the board of trustees giving the information asked for on the appended form in the back of this bulletin.

It is intended to help the rural community in every legitimate way without entering into competition with architects. For this reason only simpler designs of one and two room buildings have been included. Where more elaborate buildings are possible the services of an architect should be secured so that the buildings can be adapted more particularly to the site and to the needs of the community. An architect should not only be employed to make the plans but to superintend the construction.

Boards of trustees are too apt to look upon the employment of an architect as a useless expense, but a little investigation would easily convince them that such is not the case.

In preparing with many interruptions this bulletin and the detail plans which supplement it, there is every opportunity for error, and while care has been used in checking, it is hardly to be hoped that they will be free from errors especially in the detail plans which total some thiry or forty sheets 24x30 inches. We would consider it quite a kindness if builders and others using our plans would report any discrepancies, ambiguities, or errors, so that they can be corrected on the tracings.

W. R. PLEW,
Bozeman, Montana.

The School Site.

The proper selection of a school site involves the careful consideration of a few qualities that are not independent of each other. It goes without saying that perhaps no site could be found wherein all the various requisites of a good location are perfectly combined. It will, therefore, be neccessary for those intrusted with the selection after carefully considering all advantages and disadvantages, and by balancing one against the other, to select that site which most nearly comes up to the ideal, remembering always that the best is none too good.

Following are the principal things to be considered in making a selection:

1 **Centrality.** Considering this element by itself the proper location is at the center of population in the district, taking into account a careful survey of its future developmentment. While this is desirable it is unwise to put too much weight on this feature. A half mile more or less walk for three or four pupils should not weigh heavily against other good qualities.

2. **Accessibility.** Accessibility should be given more weight than centrality. The danger from railroad and interurban crossings, bad bridges, fords, etc., as well as the advantage of being near or on a principal road should be considered. With the topography characteristic of Montana, there may be considerable discrepancy between the road distance and the real distance. In fact, centrality might be included under this head since we can say the site should be so located that the largest number of pupils may reach it most conveniently.

3. **Natural Fitness.** Usually too little attention is given to the appearance of the surroundings. Aesthetic surroundings have a perfectly definite and tangible value. This element is more frequently ignored in village than in country districts, but even here it receives too little attention. The site should be the most beautiful in the district. Frequently a site covered with beautiful trees can just as well be chosen as a bare and unattractive one.

4. **Size of Grounds.** One room schools should have a minimum of one acre and two rooms a minimum of two

acres, in order to provide sufficient room for playgrounds, gardens, etc. Playgrounds should not be considered a luxury but a necessity; an institution without them is a deformity. The best shape for a one acre lot is 10 rods front by 16 rods deep; for a two acre tract, 16 rods front by 20 rods deep. Where two or three acres can be provided for ample playgrounds and gardens it is highly desirable.

5. **Sanitation.** Sites should be selected with regard to, and the understanding of, the sanitary requirements of a rural school. A site that cannot be well drained, and freed from natural dampness should be barred from consideration. It should not be on made ground which is likely to be impregnated with all kinds of decaying organic matter. A little foresight and thought might make available with a very slight expenditure of money for some of the modern appliances, a water supply and water carriage sewage disposal. It is not at all difficult in certain sections of the state to accomplish this by a little judicious foresight. With this end in view, certain sections in the bulletin are devoted to explaining some methods that may be employed in accomplishing the desired results.

6. **Irrigation.** Where possible it is very desirable that the site should be situated so that it may be irrigated. Where gardening is conducted this is almost essential. Irrigation is also essential to a fine, well kept lawn, which should be the ideal of every school.

7. **Protection.** Advantage may sometimes be taken of timber or topography, to give a location, to some extent protection from the prevailing winter winds, and at the same time allowing a maximum of sunlight. While no great sacrifice can be made in the other requirements to attain this end, it is well worth considering.

THE LAYOUT OF THE LOT.

For a formal layout, the building should be placed on the longer axis of the lot about fifty feet from the front if proportions as given above, are adopted. When no provision is made for fuel inside the building, a neat coal or fuel house should be built directly back of the school building and on the longer axis of the lot.

Privies should be located at the rear and opposite corners of the lot, well screened in with vines and lattice. Where the lot is long so that they would be inconveniently far away, they may be placed on opposite sides, in a way to leave an athletic field or ball ground to the rear of them.

The property should be neatly fenced. About ten feet inside the fence a row of trees should be planted. Where necessary, sheds or stalls for horses should be provided and properly screened. On pages 11 and 12 are given examples of two well planned yards which are intended to be used as suggestive models.

BEAUTIFYING THE GROUNDS.

As a rule during the stress of building little attention is given to beautifying the grounds, but since it costs no more at least to consider the possibilities for future development, much grief may be avoided by having in mind some of the principles of landscape gardening, and if possible a fairly definite plan for improvement. A forlorn, wind-swept school ground renders the school, which should be a thing of pride to the community and pupils, a place of weariness and desolation.

Style of Layout. There are two general classes of landscape layouts, the formal and the informal. The formal is adapted to regularly formed and fairly level lots. The fundamental characteristic is regularity, being rather geometrical in form. The tendency is too much toward this style, which, unless orderly and perfectly kept looses its essential element.

The informal is the opposite of formal. Its prinicpal characteristic is grace and naturalness. It is admirably adapted to rural school grounds in the western country because it permits advantage to be taken of topography and surroundings. Where irrigation is possible it lends itself to this form and opens up endless possibilities.

The first essential for the work of beautifying the grounds is a plan. The begining of the plan may be a rough sketch of the area on which the school building stands with direction and distance marked upon it locating the permanent objects, such as trees and buildings. The prinicpal lines of travel leading to the school house should be used as a basis of permanent walks unless there is some good reason for changing them. The walks and drives should be straight if the distances are less than 100 feet, and gently curved if longer, so as to admit the use of trees and shrubs along the the border. The outlook from each door and window should be carefully inspected before determining which objects in the landscape should be retained in view and which hidden or concealed by the use of trees or shrubs.

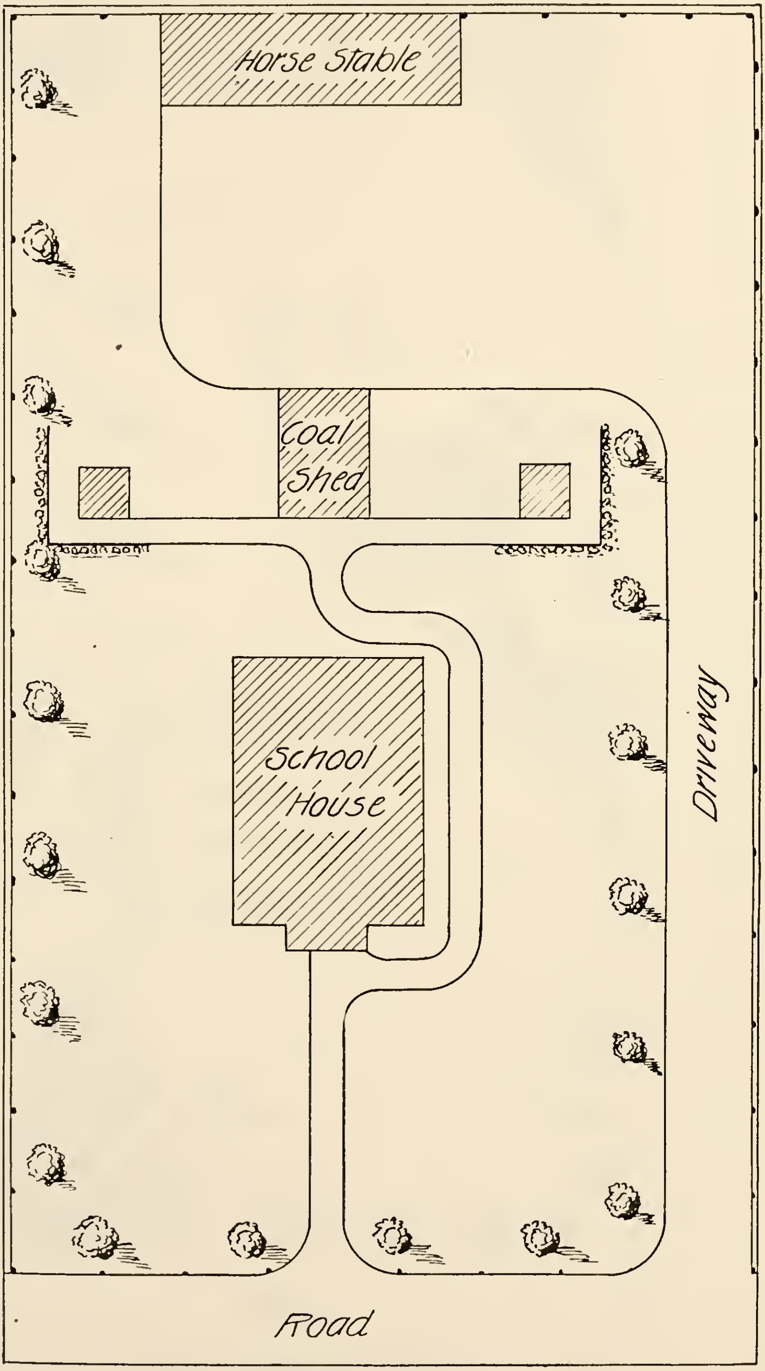
Trees and shrubs should be confined chiefly to the borders of the place, an open and unbroken lawn being preserved

in front and at the sides and rear where the playgrounds are to be maintained. In rural districts the trees should be so located as to give protection from storms in winter and from sun in summer, and at the same time produce a pleasing effect. Walks leading to and from school should be direct, but where space will permit, they should have gentle and pleasing curves which conform to the contour of the ground. Upon level areas it is well to allow an artistic use of shrubs in groups in the bays which shall serve to break the monotony and obtrusiveness of unscreened straight walks across an open lawn. Lawns are the foundation of all decorative planting. A good, well kept lawn contributes more to the beauty of grounds than any other single factor. For this reason special attention should be given to grading, cultivation and enriching of the area to be devoted to the lawn. Shrubbery groups can be arranged so as to separate one portion of the ground from another and yet not interfere with large open spaces suitable for playgrounds.

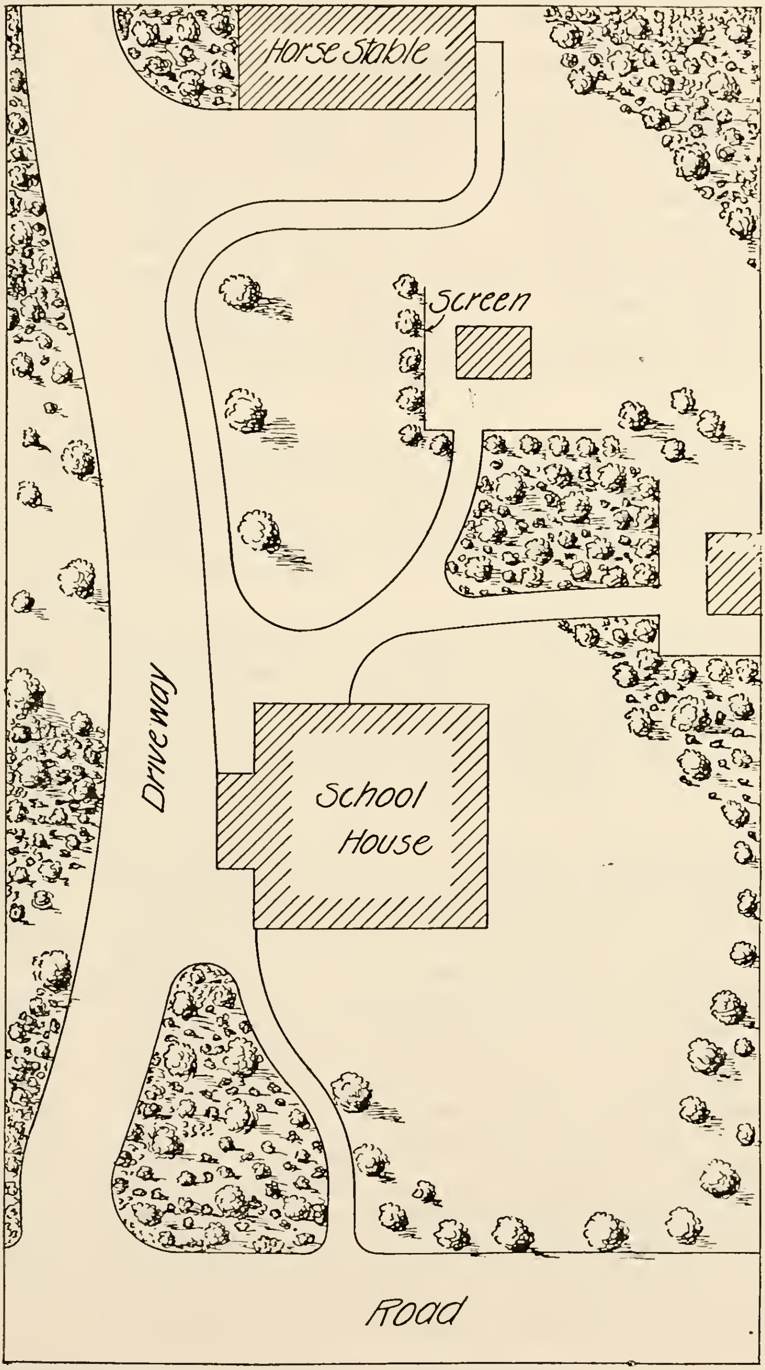
The work of beautifying the school grounds may be and should be made both a work of utility and instruction. It should be an object lesson to the community.

In order to promote this interest a plan has been worked out whereby the planning of landscape improvements for either new or old sites may be worked up by the school children cooperating with the College of Agriculture and Mechanic Arts. To do this each pupil should make a carefully scaled plat of the grounds, including immediate surroundings on which is indicated buildings, walks, drives, etc., and by name or number the variety and location of each existing or proposed tree or shrub. After the sketches are finished and carefully checked by the teacher, they should be forwarded to the Department of Architectural Engineering, State College, Bozeman, where, in connection with the Horticultural Department, a study will be made from them and recommendations made to the teacher. By judicious use of this idea the teacher should be able not only to stimulate considerable interest in the improvement of the grounds over the district, but also to furnish motivation for drawing and arithmetic among the pupils.

On the following pages are suggestive plans for both the formal and informal layout:



FORMAL PLAN—FIG. 1.



INFORMAL PLAN—FIG. 2.

THE PROPER BUILDING.

The building should be of size sufficient to take care of the immediate and future needs of the district under the rulings of the State Board of Health and the laws of Montana, which state that, "250 cubic feet of air space must be provided for each child." It should also be a little better and more complete than the trustees usually think they can afford. When an adequate building is being considered it is not so much a question of what can be afforded but of possibilities. When the district cannot legally raise the money for a better building, good results are often obtained by an appeal to the residents of the district for voluntary aid.

On succeeding pages are plans for buildings furnishing the very barest necessities as well as plans fairly complete and modern. If at all possible one of the modern plans with basement should be selected, and located where the uses of water under pressure may be had, either by gravity, or pressure tank.

Orientation. The building should be placed so that the light enters the class room from the east or west, preferably the east. Some authorities recommend a north light but for a school in the latitude of Montana this would be too cheerless and gloomy during the winter months. It should be possible to flood the school room at some time during the day with bright sunlight.

The Class Room. The desks should be arranged so that the pupils will have the class room windows on their left. Windows should not be separated by any appreciable distance, which always results in cross lights, very annoying as well as injurious to the children's eyes. They should, therefore be placed on one side and be practically in one frame. On all the following plans the windows are within one foot of the ceiling, which is as it should be. Of course, it is a little more trouble and expense but since the best light from the pupil's standpoint comes from the upper half, it is well worth it, and should be insisted upon in building. Under no circumstances should there be windows in front of the pupils. If windows in the rear are insisted upon, they should be transom windows above the blackboard and should be provided with shades so that the eyesight of the teacher may be protected. According to the rulings of the State Board of Health, "all windows shall come within one foot of the ceiling and the area of the glass in the windows must not be less than one-seventh of the floor area.

All windows must be on one side and rear of the room. No blackboard shall be placed between windows." All windows should be provided with shades enabling the light to be taken from any part of the window. This may be accomplished with movable curtains, which work in slides, so that the entire shade may be moved up and down by means of a string. Double shades, one working from the top down, and the other from the bottom up, also give good satisfaction. The same result may be secured by mounting one shade at the top of the window and another opposite the meeting rail in the middle of the window, both working down. In color the shades should harmonize with the walls and be translucent.

The Wall. The beauty and attractiveness of a school room depends to a great degree on the interior finish and the tinting of the walls. No building should be considered ready for occupancy without having the walls tinted, and the matter of selection of tint should not be left to the mere whim of whoever happens to be on the ground. Deep blue, yellows and reds are fully as bad as glaring white walls and indeed may not look so well.

Perhaps the best wall color for school rooms is a sort of greenish gray, more gray than green. In fact, it requires considerable care to avoid the use of too much green. This color on the walls with a green stain on the interior finish makes a good looking interior and is easy on the eyes. All interior finish should be dull. Gloss finish reflects light and causes an unnecessary eye strain.

Some form of cold or hot water paint, commonly known as calcimine, will be found to give the best satisfaction on walls. Of course, unlike oil wall paint, it cannot be washed, but it can be renewed for practically what it would cost to wash a coat of oil paint.

A picture mould should be provided for the class room, and placed about 18 inches below the ceiling. Select a plain mould, at all times avoiding deep cut and pressed moulds, which collect dirt and dust and become unsanitary.

HEATING AND VENTILATING.

A ruling of the State Board of Health reads as follows: "The number of pupils seated in a room must be regulated so that each child shall have not less than 250 cubic feet of air space. The ventilating space should be such that each child will be supplied with not less than 1250 cubic feet of fresh air per hour. Where the amount of air space provided for each student does not exceed 200 cubic feet, the air in the

room must be changed not less than five times per hour. In buildings of more than four rooms some form of forced ventilated must be provided." Another ruling for heating: "The heating plant must be of such character that the temperature of the room or rooms can easily be kept at 70 degrees during the most severe weather."

These requirements are severe. It is well, therefore, to discuss at some length the various methods employd.

Stoves. With plain unjacketed stoves it is impossible to approach the requirements so only jacketed stoves will be considered. For small one room schools the jacketed stove or school heater properly installed will give good results, but it is not as convenient, nor as satisfactory as a properly installed furnace.

Jacketed stoves should have heat proof metal jackets with open top, a fresh air intake from outside the building, and foul air flue, discharging from the room into the chimney. All of these should be of size sufficient to give the required amount of circulation. The outer jacket should be made of heavy galvanized iron, or other equally durable material and lined with sheet asbestos. The inner jacket should be of tin and separated from the outer jacket by an air space of at least 3-4 of an inch. The inner jacket should have five inches for a minimum distance from stove to jacket, and should extend from the top of the stove to the tray, or foundation on which the heater rests. Fresh air ducts from the outside should be so arranged that sufficient air will be discharged inside the jacket at the floor. The lower 12 inches of the jacket may be provided with sliding doors so that the air in the room may be recirculated for quick heating. They should, however, be kept closed while school is in session. There are a number of excellent school heaters on the market which are nothing more than jacketed stoves specially built, and which should be investigated before attempting to build a jacketed stove.

In installing heaters of this type they should be so situated that the smoke-pipe connection between heater and flue will not be over five feet measured horizontally. No metal, tile, or other smoke pipe should extend through the walls, ceiling or roof in any manner. Each room in which a heater is installed should have a masonry chimney having either a single or double flue, depending upon whether the foul air is mixed with the smoke or not. Where double flue chimneys are used they should be entirely within the building, since the circulation of the foul air depends upon the temperature of the foul air flue. For this same reason the smoke flue and foul air flue should always be in the

same chimney and separated from each other by a maximum of four inches. Better service will be had by using a non-corroding metal smoke flue inside the foul air stack, in which case it should be well braced and stayed, by metal ties to the chimney side.

If the same flue is used for both foul air and smoke, a mixing chamber or drum is necessary for bringing the smoke and air together, otherwise, the draft may be all from one leg of the pipe. This drum should have an area around the smoke pipe equal to that of the flue. A common method is to take the foul air from a point six inches above the floor through a pipe to a mixing drum located on the smoke pipe where it enters the flue. A better and neater way is to open the foul air vent into the flue at the floor line, using a register with louvre damper. The register should have a net area equal to that of the flue.

Furnace. Where the ground area does not exceed 1200 square feet the furnace is undoubtedly the most efficient and satisfactory of all methods of heating a school building. When properly installed it is clean, easy to manage, and is economical in first cost. It furnishes an excellent means of ventilation, and is in every way the ideal heating system for the rural school.

In principle, the hot air furnace is simply a stove or heater enclosed in a metal or brick jacket in such a way as to form an air chamber between the heater and casing. Cold air from the outside by gravity enters this chamber at the bottom, passes over the heated surface of the heater and is conducted to the rooms through pipes discharging at seven feet above the floor. The circulation is produced by the difference in weight between the column of air in the hot air pipes and an equal column in the cold air pipes. It is clear that the furnace having the most radiating surface in proportion to the size of the fire pot will be the most economical of fuel, but since the area of the radiating surface for furnaces of the same material vary as the weight, and weight as the cost, it is clear that cheap furnaces are not economical of fuel. While it is true that one furnace may have its radiating surface better arranged than others, it is seldom true that a very light furnace, particularly if of cast iron, is a good heater.

Besides having a large radiating surface the furnaces should have as few joints as possible and be so arranged as to be easily cleaned. Furnaces are constructed of cast iron, steel, or wrought iron, either singly or combined. The radiating surface above the fire pot can be made more cheap-

ly of wrought iron than of cast iron and in certain arrangements is just as good.

Light steel furnaces are to be avoided. While there are furnaces made of boiler plate riveted that undoubtedly give good service and are in every way satisfactory they must not be confused with those light flimsy steel furnaces with which the market is flooded.

Furnaces are manufactured in various sizes and styles. Sizes are usually listed in trade literature giving the room capacities, etc., of each size. In selecting a furnace for school heating the next larger than the listed size should be used because of the fact that ventilating requirements make heavy demands on a furnace in this latitude.

The most common defects in furnace heating are overheating of the air, vitiating of the air by gases of combustion, and unevenness of heat distribution. Over-heating of the air is one of operation and not one of construction. Vitiating of the air by gases of combustion, while not entirely one of operation, is very largely so in furnaces installed by reputable furnace men. Unevenness of heat distribution is due to improper placing of the furnace or improperly proportioned distributing pipes. By all means, the services of a reputable and experienced furnace man should be secured to install the furnace, since nearly all the defects are due to improper installation or mismanagement. It, perhaps, is not too much to say that most furnaces are not installed in the best manner. If steam or hot water plants were installed with anything like the lack of care and judgment that are given the average hot air plant, they would not work at all.

The furnace should be located in the basement and as near the center of gravity of the registers as possible, except that in a locality of strong winds it should be a little nearer the side from which the wind prevails. This helps to overcome the tendency to force the hot air to the leeward side.

The leaders or horizontal hot air pipes should have a pitch of 1½ inches upward per running foot from the furnace.

For buildings in very windy situations it is desirable if possible to have a cold air intake on both the windward and leeward side, each provided with dampers so that either or both may be used. It is not an uncommon thing for the current through the furnace to be reversed by the vacuum formed on the leeward side by the wind.

Size of Ducts. Ducts should be proportioned to provide 1250 cubic feet of fresh air per hour in rooms having

250 cubic feet of room space per child, or when the room space is not over 200 cubic feet per child to provide a complete change of air five times per hour.

Fresh air entering a building, however, is from two sources, that which is systematically introduced and that entering by other means. The tendency is to neglect the non-systematic ventilation, and to count for ventilation only that air furnished through the fresh air duct. This is certainly unfair and works a hardship on the furnace in cold and windy weather and also in warm or very mild weather. All buildings of ordinary construction receive some ventilation whenever there is a difference between the outside and inside temperatures. It has been found that in a building of good frame construction there is a change of air at least once per hour for a difference in temperature of 34° F. when no stove or furnace is in use. With the same difference of temperature, but with the addition of a good fire in the stove, the change is about 1½ times per hour. This difference is accounted for by the air taken from the room through the draft of the stove, being replaced by outside air. In the same test with all the crevices and openings about the doors and windows pasted up air tight, the change is about ¾ of the contents per hour, showing that there is considerable leakage through a well constructed wall. For zero weather with some wind outside, and inside temperature of 70°, it has been found that the changes of air were about three times per hour, or 60% of that required by the State Board of Health. Since this leakage is proportional to the difference of temperature inside and outside, and also increases for windy conditions, it is clear that due account should be taken of both systematic and non-systematic sources when reckoning the changes of air. On this account an outside intake should be located on the windward side and provided with a damper whereby the amount of systematic ventilation can be regulated. Reheat ducts should also be provided so that the temperature of the room may be kept up in extreme cold or windy weather, when it will not be necessary to use a great deal of outside air.

Whenever air is introduced into a room an equal amount of air must be displaced or driven from the room. Neglect of this perfectly obvious thing accounts for the fact that many furnaces do not give satisfactory service. The vent for foul air should be a little larger than the fresh air intake, on account of the air being warmer and hence occupying more space.

Following is a table giving sizes of flue, fresh air duct

and vent pipe to be used in rooms of various sizes when the same flue is used for smoke and foul air.

TABLE I.

	Cubic Feet in Room		
	8000 or less	8000 to 12000	12000 to 16000
Cross-sectional area of chimney not less than .... sq. in.	144	256	400
Diameter of vent pipe not less than .... in.	12	16	20
Free area of foul air vent not less than .... sq. in.	144	256	400
Cross-sectional area of fresh air intake not less than .... sq. in.	144	256	400

The following dimensions are to be used when the system has separate flues for smoke and foul air.

	Cubic Feet in Room		
	8000 or less	8000 to 12000	12000 to 16000
Cross-sectional area of smoke flue not less than	64	96	144
Cross-sectional area of vent flue not less than	189	525	651
Free area of foul air vent not less than	189	525	651
Cross-sectional area of fresh air intake not less than	144	265	400

Humidity. Hot air at 72° in a room, may cause to the occupant a chilly, uncomfortable feeling, while the same room at a temperature of 62°, with a proper humidity and plenty of fresh air will be more pleasant and healthful. There is also economy in the fuel consumed.

Air moisture or humidity is everywhere, even in the desert. Its distribution is uneven and variable. It is greater in winter than in summer, less at high than low altitudes. In a single night the percentage of moisture may vary from 40 to 80% without intervention of rainfall or heavy fog.

The average teacher attributes atmospheric discomforts solely to the temperature, either the air is too hot or too

cold, and to these extremes she will charge a multitude of physical ailments which may properly belong to the moisture content of the air.

Air thoroughly saturated with moisture, as in a fog, is said to have 100% relative humidity; air in a desiccator, air containing no moisture, is said to have 0% humidity, and all intermediate conditions are expressed in a percentage between 0 and 100. This percentage varies with the temperature, being reduced as the air is heated, due to the fact that the total moisture content or absolute humidity of air is the same, while its saturation point or 100% point on the relative humidity scale has been raised.

The average humidity of outdoor air is about 70%, while the same air indoors, where no effort is made to add moisture when the temperature is raised, is from 10 to 20%. This is a dryness not equaled in nature.

While the physiological effects of dry air are not thoroughly worked out it is well understood that from the health standpoint it is very undesirable. It shows itself in parched lips, a feverish condition of the skin, a hacking cough, and chilly sensations. Everything considered it appears that about 50% humidity is proper.

Practically everyone is convinced of the advisability of keeping the humidity up, but few seem to appreciate the effort required to do it. In fact few furnace makers provide facilities sufficient to evaporate enough water to do so.

As an example, take the outside temperature at 0° and a 70% humidity, which is somewhere near the average. To maintain a humidity of 50% at a temperature of 70° inside a room 19x24 and having a 12 foot ceiling and five changes of air per hour would require the evaporation of two gallons of water per hour.

From this it is evident that the usual small vessel on the back of the stove, or the small water pan set in the jacket of the furnace is entirely inadequate. It also shows the hopelessness of having the average rural school maintain the proper degree of humidity. But, while with five changes of air per hour under these temperature conditions it is practically impossible without special humidifying apparatus, every reasonable effort should be made to keep it as high as possible, by using larger vessels on stoves, and by having this in mind when selecting a furnace, selecting only those which seem to have adequate provisions for evaporating sufficient water.

Care of the Furnace. It may seem a little presumptious to give directions on the proper care and management of

an article in such general use as a heater or furnace, but since most of the heating troubles encountered in furnace heating are due to mismanagement, no apology is necessary for the following rules:

(1) In all furnaces there is a damper in the smoke pipe which should be regulated according to the draft in the flue, and the condition of the weather. It should be kept enough open so that the draft will not be sluggish. During windy weather it should be kept more nearly closed than in still or humid weather, but should not be used to regulate the temperature of the furnace, as there is a front and back check for this purpose. It may be opened while adding fuel, thereby creating a draft through the feed door and preventing smoke and dust entering the furnace room. It should be returned to its original position after firing.

(2) Put but little coal on a low fire.

(3) When adding a large amount of coal leave a part of fire or flame exposed so that gases may be burned as they rise.

(4) Learn to use the back check damper,—do not depend entirely on the ash pit damper.

(5) Carry a deep fire, let the live coals come up almost to the feed door, even in mild weather, when from four to six inches of ashes should stand on the grate. Avoid holes in the fire. With a good big fire in which there is a hole the size of two hands good results are impossible.

(6) In severe weather give the furnace the most careful attention when leaving at night.

(7) Do not shake or poke the fire in mild weather. Occasionally shake down enough ashes to give place for a little more fuel.

(8) Do not let the ashes bank up under the grates in the ash pit. This will burn out the grates. The ash pit should be emptied once each day.

(9) In severe weather keep the fire pot full of coal and run the heater with the dampers. Thoroughly clean the grates once a day. Let the top of the fire be almost level with the feed door sill. Bank up the coal higher in the rear.

(10) In firing up of a morning in moderate or cold weather, shake the fire down some and see that there is an

even bed of coals. On this, place a thin layer of fresh coal and set the dampers for a brisk fire. Close the outside intake and use only air from inside, or recirculated air. After the new fire is well started and furnace well warmed up put in as much coal as may be necessary. When the room becomes warm change the intake from the inside to outside air.

(11) Don't fuss with or poke the fire, it always takes time for a fire to get under way.

(12) At recess and other periods of rest, open some of the windows to freshen the air in the room. Especially is this necessary in mild weather since so brisk a fire is not needed and consequently the ciruclation or introduction of fresh air into the room is more sluggish. In severe weather this direct ventilation will not be necessary.

BLACKBOARDS.

Amount. There is little possibility of having too many lineal feet of blackboard in a rural school where the walls are cut up with windows and doors necessary to a self contained plant. Since rural schools have pupils of all sizes, 48 inch blackboards should more generally be used.

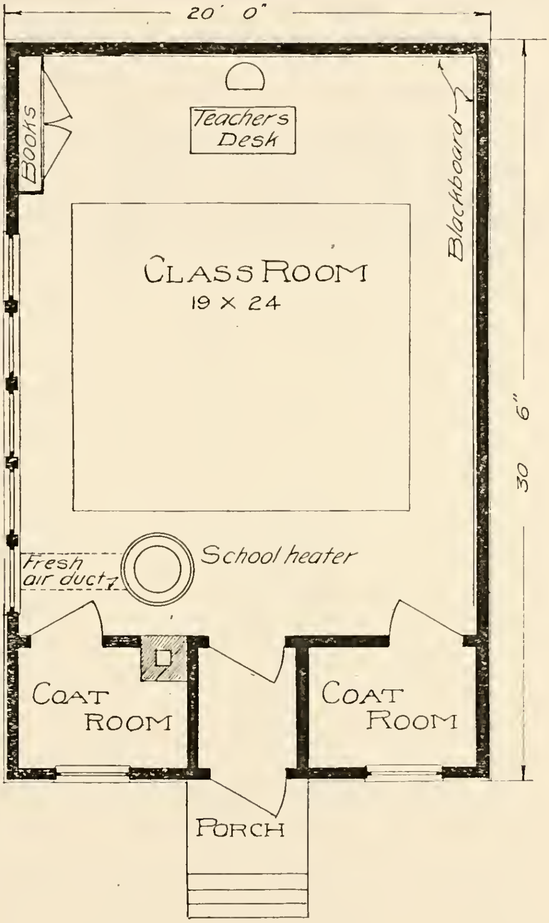
Location. They should never be located on the light side of the room. The eye strain for both the pupils and teacher is enormous when so located.

The proper distance from the floor for the lower grades is from 25 to 27½ inches; for the upper grades from 28 to 30 inches.

Material. There is no doubt that slate makes the most satisfactory black board obtainable, but the cost delivered in Montana is so great that it is doubtful whether it is ever advisable to use it in rural schools, unless the purchase can be made by combining orders sufficient to make a fair sized freight shipment. There are, however, on the market various brands of slate coated fibre boards, which, when properly installed and cared for, give excellent satisfaction. It is necessary that they be firmly fixed in place so that they will bear evenly against the wall which should be, of course, a plane. Sometimes dissatisfaction has developed in the use of these patented boards, due to their warping, checking or blistering. This is nearly always caused by improper care. Since the base in most cases is paper pulp it follows that they should never be wet. Any accumulation of dust can be removed with a rag made slightly moist with kerosene, or some of the oils used on dustless dusters.

Painted board, painted walls, or even walls plastered

with colored plaster are not satisfactory and should not be considered.



FLOOR PLAN

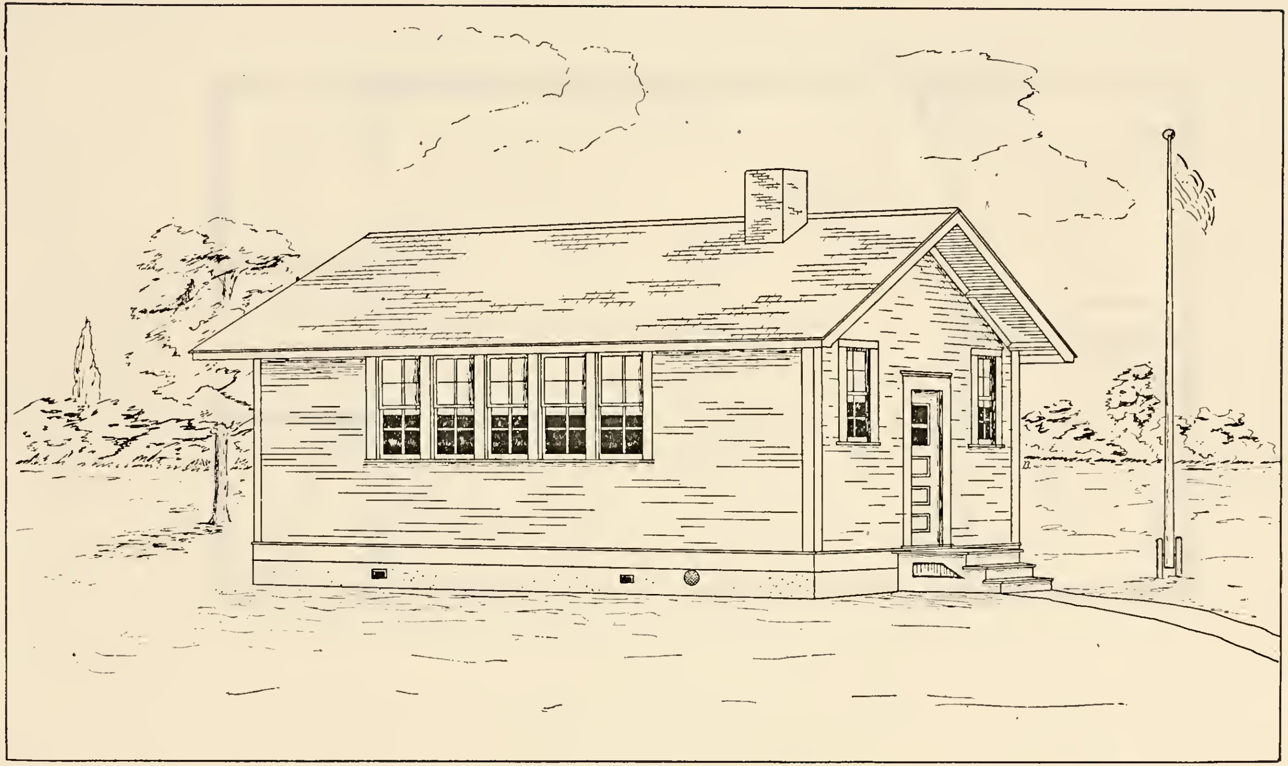
PLAN C1—FIG. 3.

Due to the undeveloped conditions of many of the rural districts there seems to be quite a demand for a plan of a small building furnishing only the barest necessities. Plan C1 was made to meet this demand. The class room 19x24 furnishes room for about twenty pupils, and it is well light-

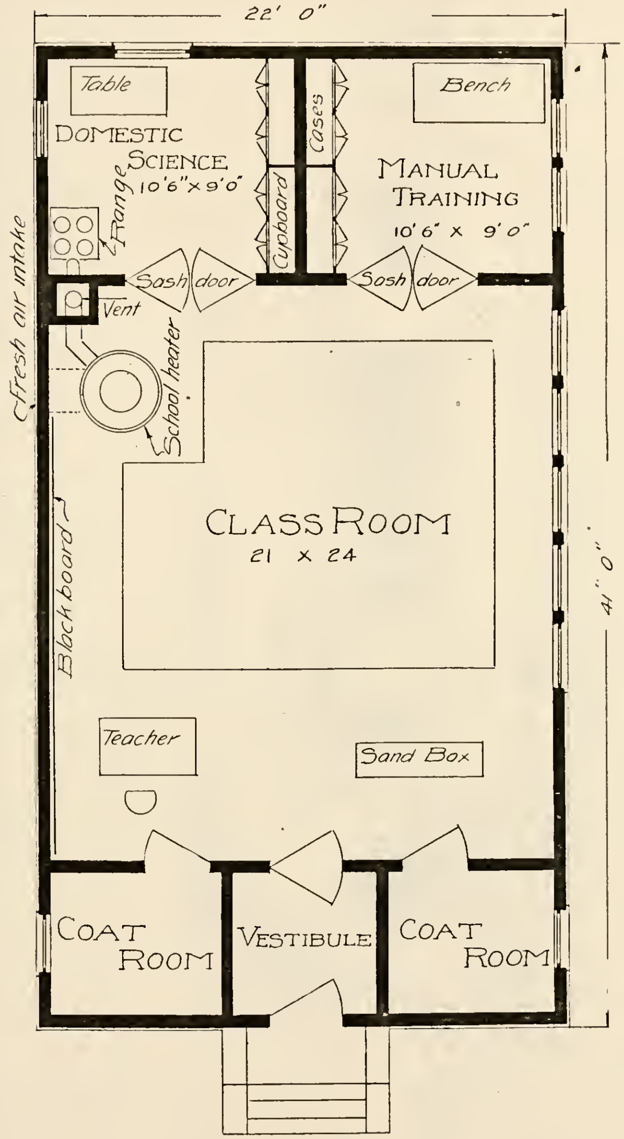
ed by banking the windows on the left. This not only furnishes the best possible lighting but leaves two large unbroken walls for blackboard space. The one behind the teacher's desk should be place 27½ inches from the floor and the other opposite the windows at 24 inches from the floor.

Heating is provided by any of the modern jacketed school room heaters having a ventilating device.

Two coat-rooms are provided, but when attendance is small and two coat rooms are not needed, the one near the stove might well be used as a fuel room. Placing the two coat rooms on each side of the entrance gives a vestibule, which, in this state is desirable and is required by law.

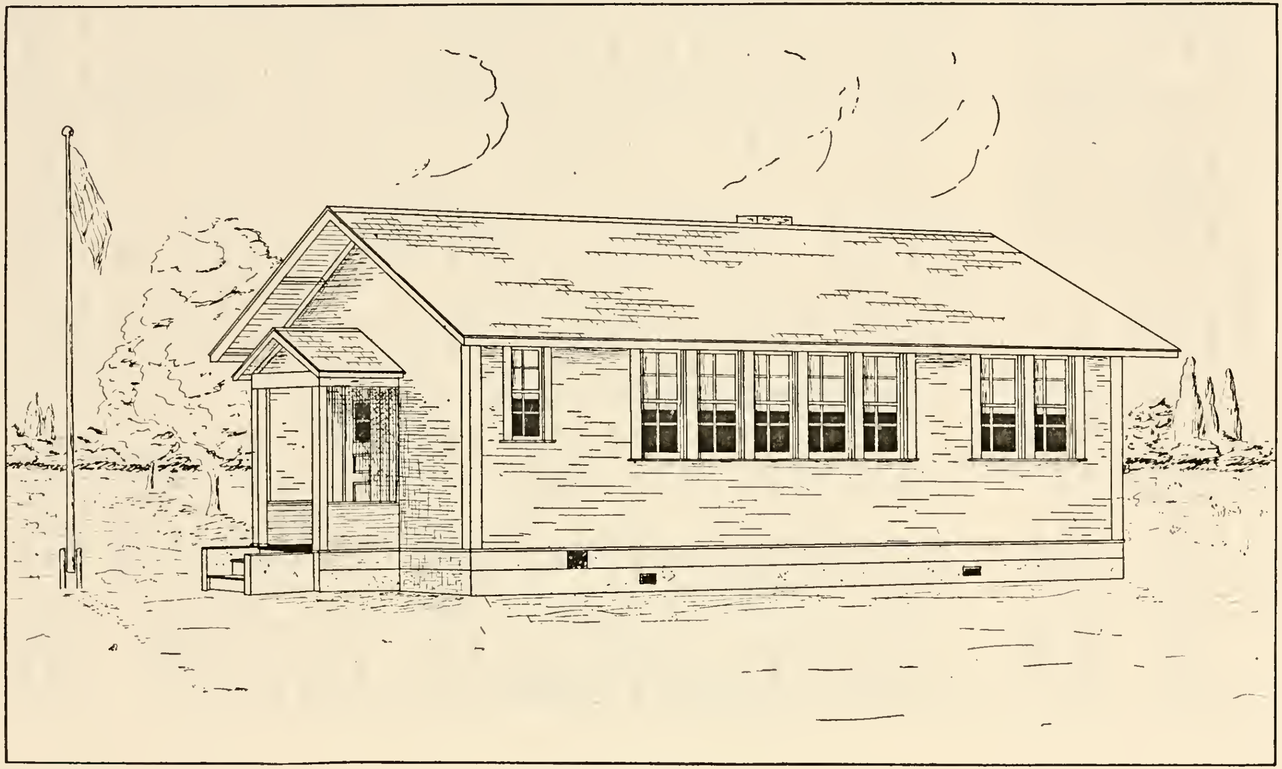


PLAN C1—FIG. 4.



FLOOR PLAN

PLAN C2—FIG. 5.



PLAN C2—FIG. 6.

Plan C1.

While this exterior is simple and plain it has not been prepared in a haphazzard manner. The proportions are carefully considered and to obtain the desired result the plans should be faithfully followed.

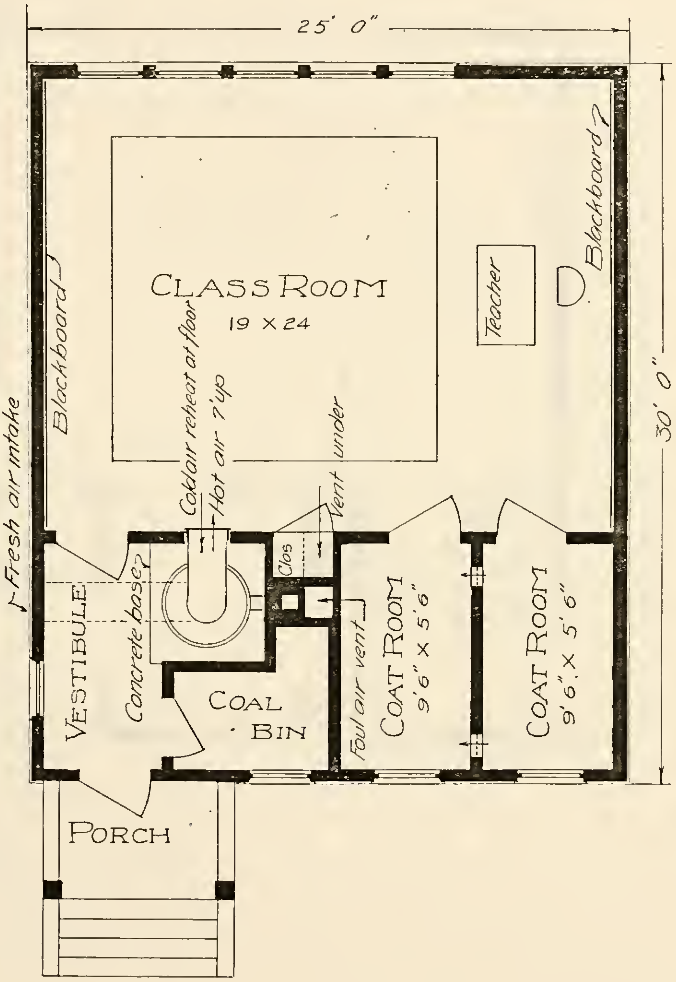
The building as shown here is adapted to a north front, but by building on the reverse plan, that is placing the windows on the opposite side, it will do for a south front.

Plan C2.

The N. E. A. committee on Industrial Education in Rural Schools makes the following general statments concerning the lines of handwork which may be undertaken in rural schools, with reasonable allowance, depending upon the character of the particular school, its location, environment, equipment, etc.: "Within this field the scope of the work may embrace the acquiring of a knowledge of scientific principles and truths essential as a basis for the proper organization and administration of the activities of the household upon a scientific basis of a knowledge of facts non-scientific in character, but necessary for proper exercise of activities within the household upon an economic basis: practice in the application and use of this knowledge. In the field of Manual Training, considered apart from the work in domestic art, economy, and science, the following ends are sought: Such training of the physical, intellectual and moral activities through the use of tools and materials and their uses, as shall enable the boy to do very many things in the line of construction and repair work necessary upon the farm which would otherwise have to be done by labor hired at considerable expense."

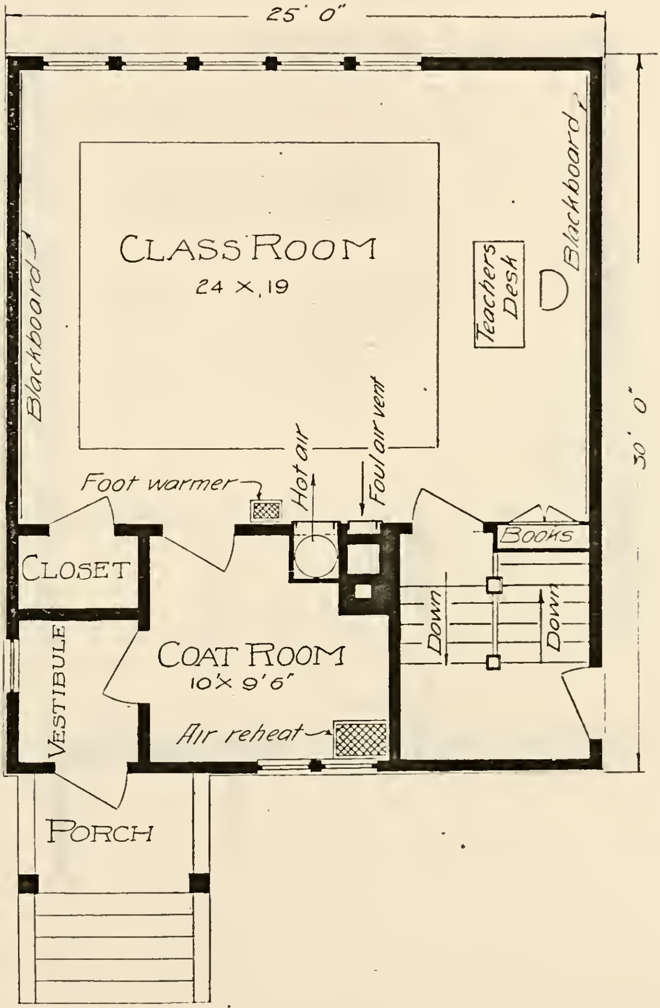
Plan C2 was developed for the purpose of furnishing facilities in these branches, with those districts in mind which hope eventually to provide the above mentioned facilities but are now unable to do so. The plan shows a few additions to C1, which make a very complete plant for a small district. The class room, coat rooms, etc., which are slightly larger than those of C1, but similarly arranged, may be built alone, and the Domestic Science, Manual Training rooms, and covered entrance, added later. Notice, however, the difference in the location of the chimney.

The Domestic Science room with range makes it possible not only to give elementary instruction in Domestic Science but also furnishes the equipment necessary to have warm lunches for the cold winter days.



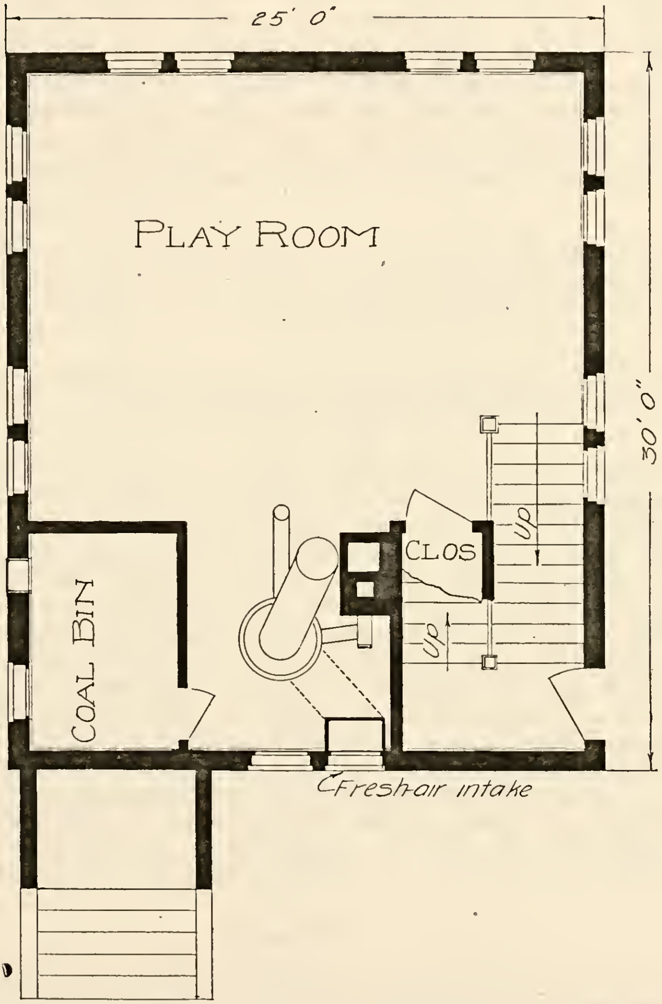
FLOOR PLAN

PLAN A1—FIG. 7



FIRST FLOOR PLAN

PLAN B1—FIG 8.



BASEMENT PLAN

PLAN B1—FIG. 9

Plan A1 and B1

For a one teacher school without basement and work room, Plan A1 should prove very satisfactory. It is rather unique in that the heater is not the ordinary school heater but a regular hot air furnace. The building is so arranged that by locking the inside vestibule door and leaving the outside door unlocked, the school room is protected for the night, while the children arriving early may go into the vestibule out of the cold.

While it might appear that the furnace is given an important place in the building, viz., in the front vestibule, it should certainly be no more objectionable there than in the school room.

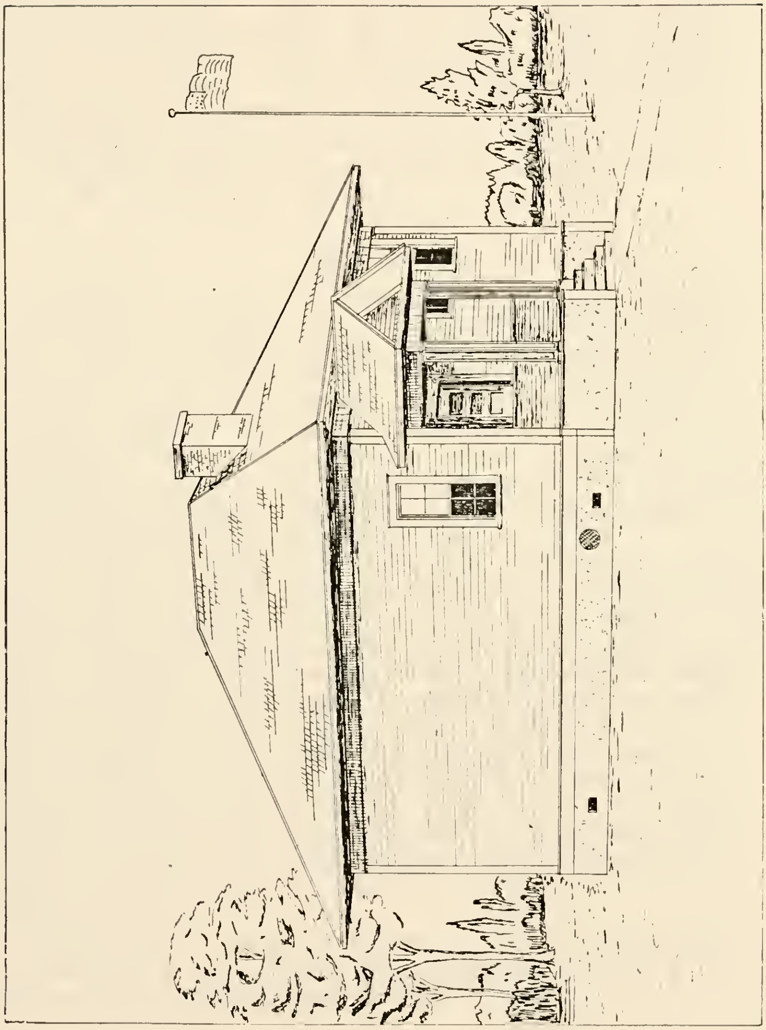
The perspective view, Fig. 10, is the same for both Plan A1 and B1. The only difference in external appearance being the basement window required by B1.

Where it is possible to do so, Plan B1 should be selected, since it gives a play room, which is a very desirable thing in this climate. The heating plant, while practically the same in cost, will be much more satisfactory when placed in the basement, not only due to the fact that all dirt which of necessity goes with a furnace as other heaters, is removed from the school room, but also because better service will be had from it, due to a more brisk circulation of the air. In most localities the extra cost for basement will not be at all commensurate with its worth, and if necessary the contract cost may be made very small by having residents of the district render voluntary aid with teams in excavating the hauling aggregate for the concrete wall and floor.

Either plan is especially adapted to a west front, but will do very well for an east front. It should not be used either for a north or south front.

Plan A2

Plan A2 offers an addition to the cloak rooms of A1, a work room and library. The work room may be fitted out with range and other accessories, which enables elementary work in Domestic Science to be given, as well as permitting warm lunches to be served to the children on cold winter days. It lacks, however, the furnace heat of Plan B1, but good results may be had with the school heater as shown. The building is best adapted to a south front, but it may be used for a north front.



PLAN A1 AND B1—FIG. 10.

Plan C3

Plan C3 is after a model built in Montana and which has proved very satisfactory. It has several points of advantage. The heater being set back into a nook leaves the class room free for seating. The rear door will be found to be very convenient. The library opening opposite the teacher's desk is always under her supervision. The cabinet built around the window in the library is provided with draws below and book shelves above the ledge.

The piano may be so located that it is out of the way and at the same time available for school use.

Plan C4B

Plan C4B was made for the purpose of furnishing all the conveniences of A2, but with a basement added, which may be built at the time the building is constructed or may be, with no great disadvantage, added later. For this reason the work room and the stairway to the basement are placed in a sort of addition to the principal building. The building is complete without the work room and coal bin, which may be added later, or the coal bin my be replaced with a stairway which will permit the basement as shown, together with all the advantages of heating that go with it.

Of course the registers, ducts, etc., shown in Figure 15 are to be used only when the basement is included, in which case the school heater shown will not be needed.

The outside door in the coal bin furnishes a convenient means of egress in carrying out ashes, while at the same time it furnishes considerable protection against the cold by using the coal bin as a sort of rear vestibule, a very desirable thing in this climate. The library, while small, is large enough to furnish all the room likely to be required for this purpose in a rural school. It is well located, being near the teacher and furnishes, as well as a place for books, a place where the teacher and pupils may have some privacy when necessary. The coat room will be found very convenient and usable.

The building is adapted to a north front, but answers very well for a south front when translucent shades of proper construction are used on the windows.

Plan B3

Plan B3. This plan is adapted to varying needs. It may be built without the basement, using the space where the stairway is located for use as a work room. Or, where water is available so that inside water carriage may be

used, the library could give way to another stairway, and the basement be divided so that separate play rooms and toilets, with separate stairways would be had for boys and girls.

While chemical toilets have not received the full endorsement of the State Board of Health, as they have not yet been well tried out in this climate, they may be used in some cases as a matter of trial. If it is desired to try them out the little nook in front of each coat room may be utilized for this purpose.

The building as shown should, however, prove to be very convenient and usable. The coat rooms, while not large, are ample for the needs of the average rural school. The library being separated from the school room by a cased opening makes close supervision over it possible at all times. The teacher's coat room, and the central storage closet, will be found quite convenient.

The building is especially adapted to a west front.

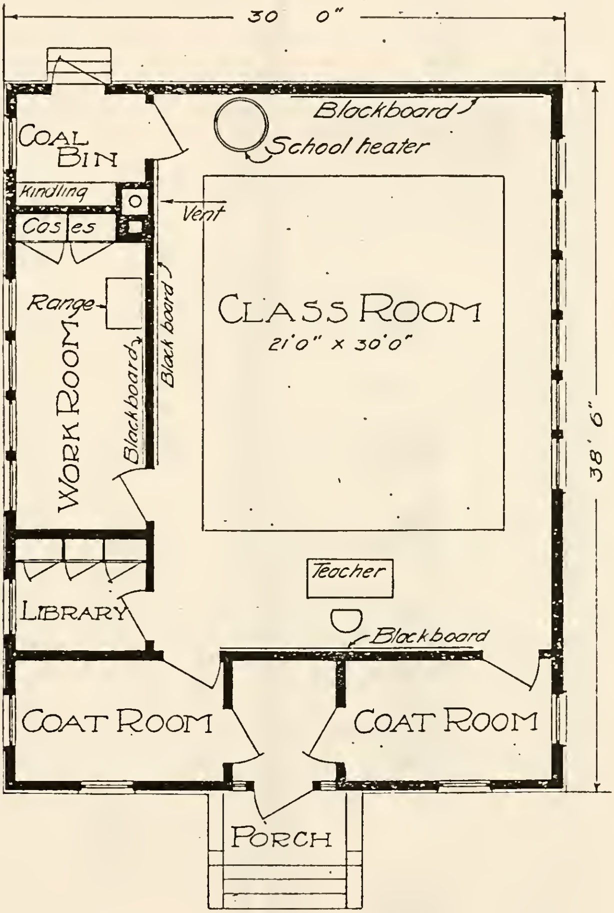
Plan A3

Plan A3. Presents a plant quite complete for a one teacher school without basement. The boys and girls room are entirely separate and provision is made for inside toilets of the chemical type. With some modification the regular water carriage system may be used where available. The work room is adjacent to the chimney, so that a range may be used for Domestic Science purposes. It is also situated so that it may be under the supervision of the teacher from the class room.

Plan A4

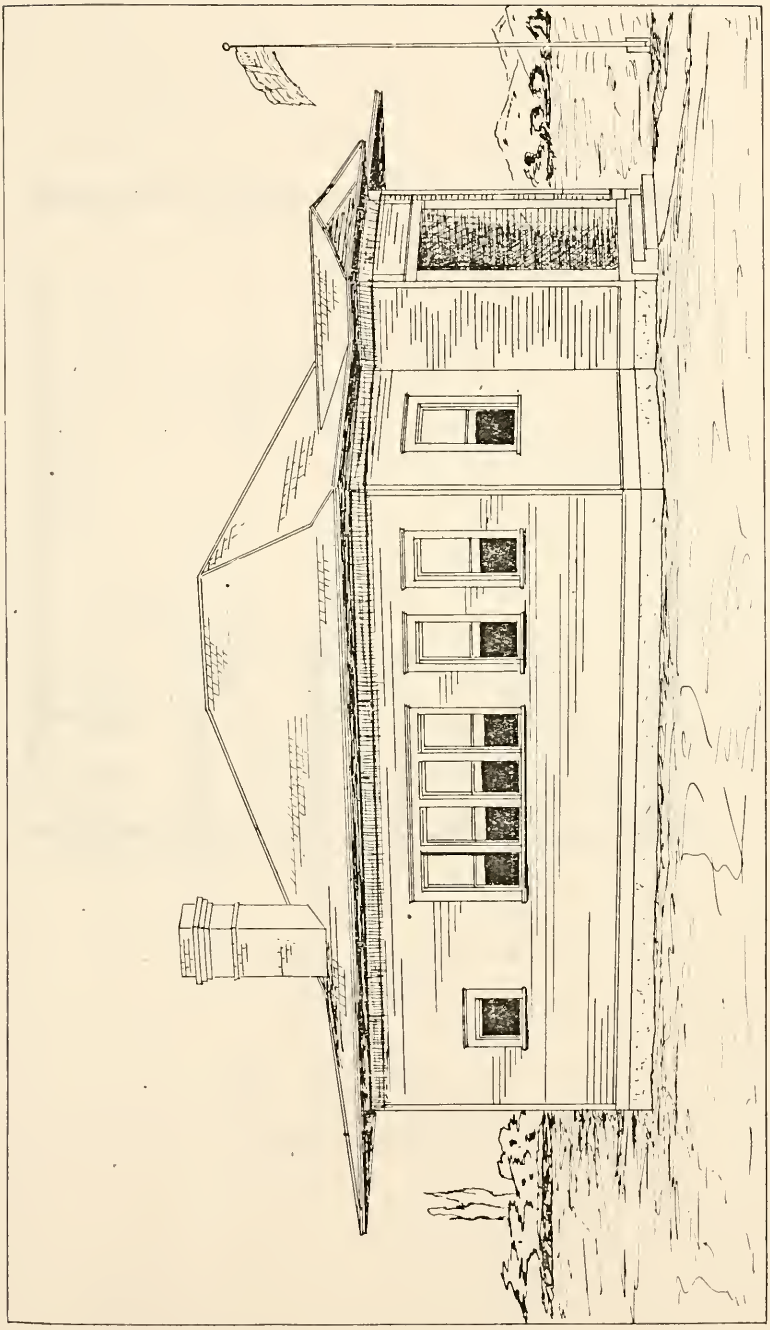
Plan A4. This is a two teacher school without basement and intended to include all the advantages of a moderately complete building. Manual Training and Domestic Science rooms are desirable, and districts populous enough for a two room school should be able to build with a basement for which Plan B2 may be selected. This building is provided with coat room, teachers' rooms, and attached fuel room, which furnishes a protected rear exit very convenient for carrying out ashes, etc. The porch in the plan is a closed porch but may be left open as in Plan A1 if desired. For very windy locations the closed porch seems to be in demand. The heating is by means of two school heaters one in each class room.

The building should face either north or south, preferably south.

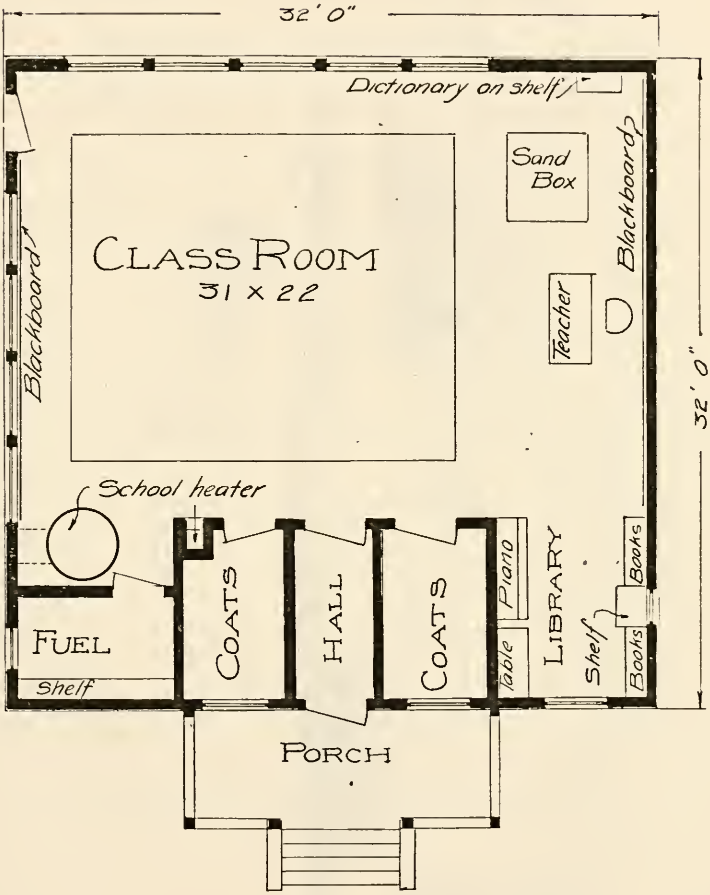


FLOOR PLAN

PLAN A2—FIG. 11

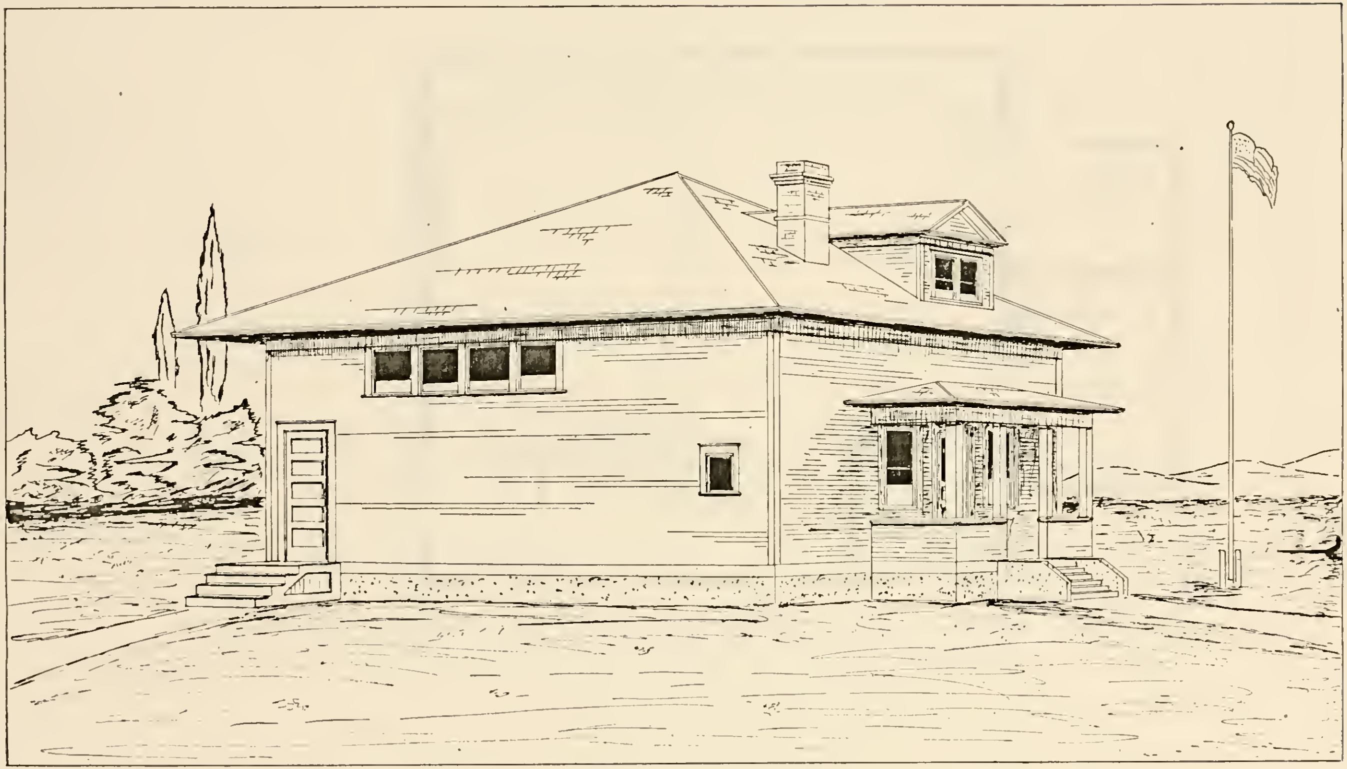


PLAN A2—FIG. 12.

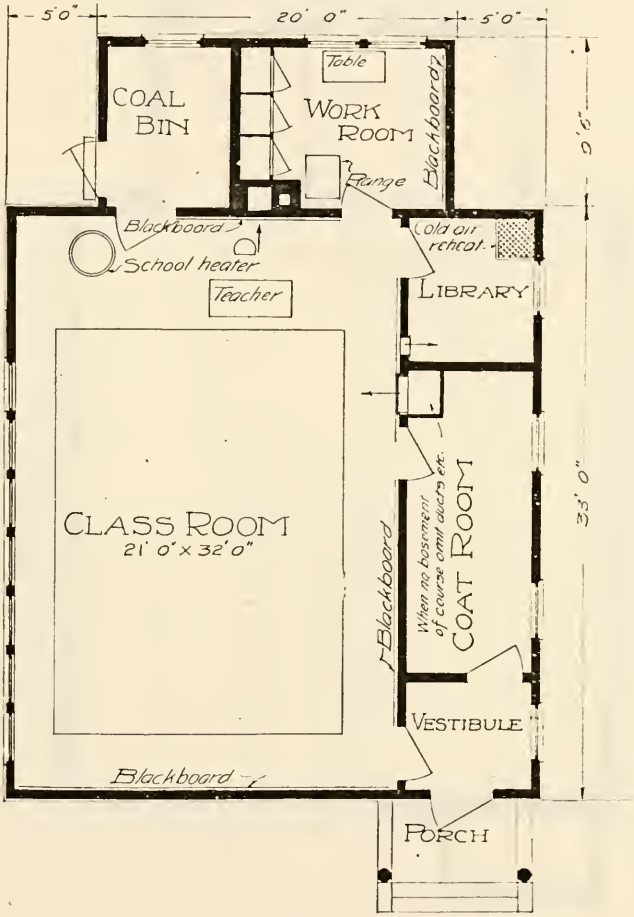


FLOOR PLAN

PLAN C3—FIG. 13.

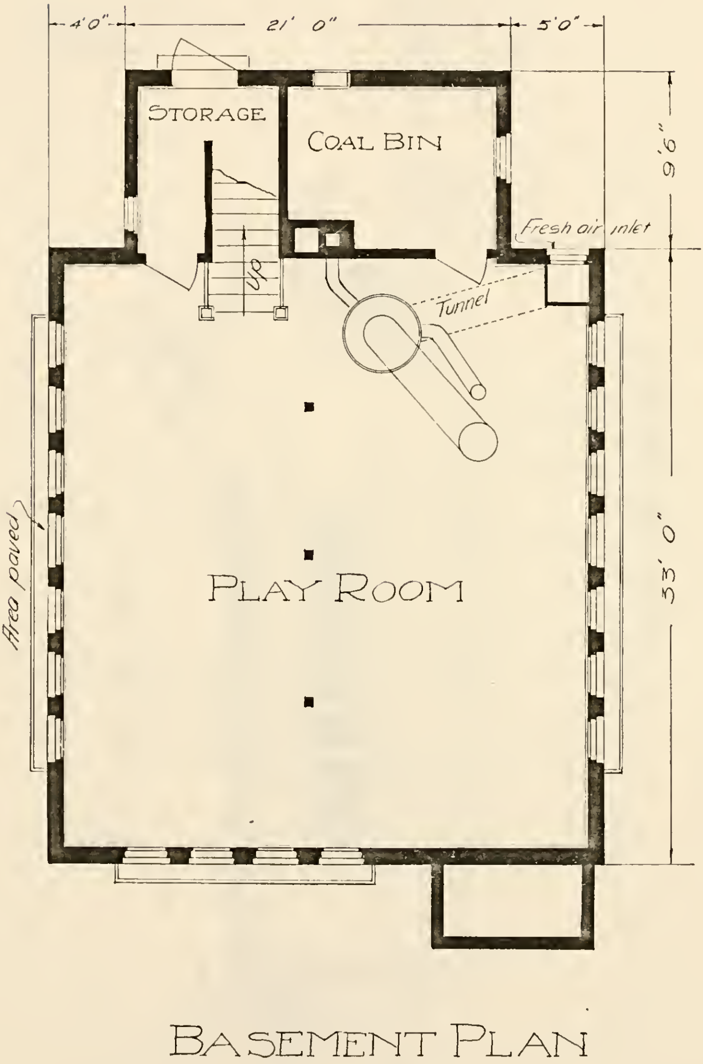


PLAN C3—FIG. 14.

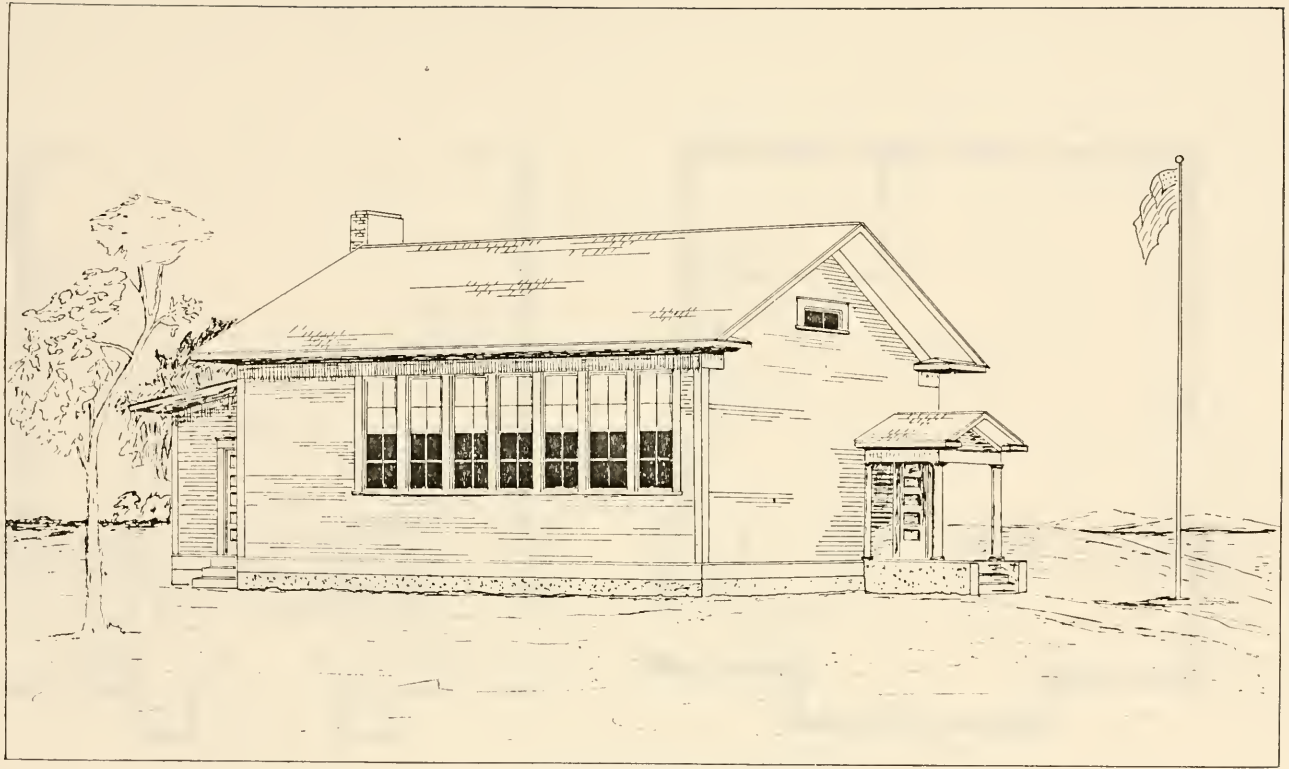


FLOOR PLAN

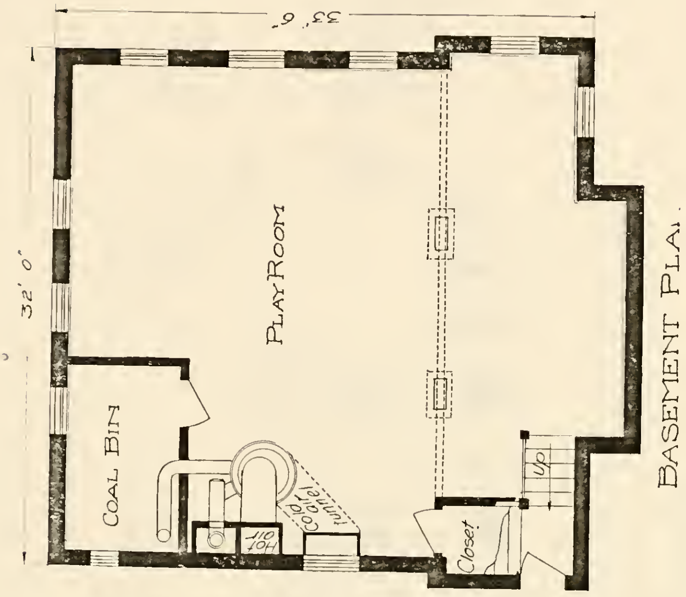
PLAN C4 AND C4B—FIG. 15.



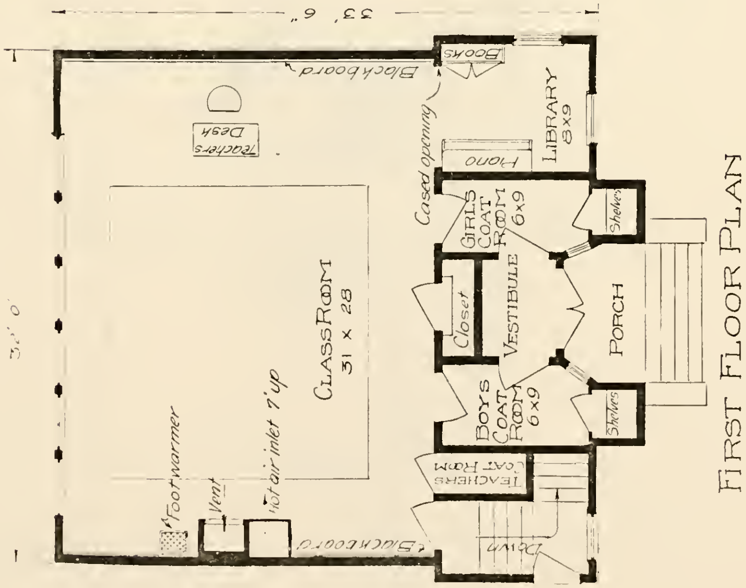
PLAN C4B—FIG. 16.



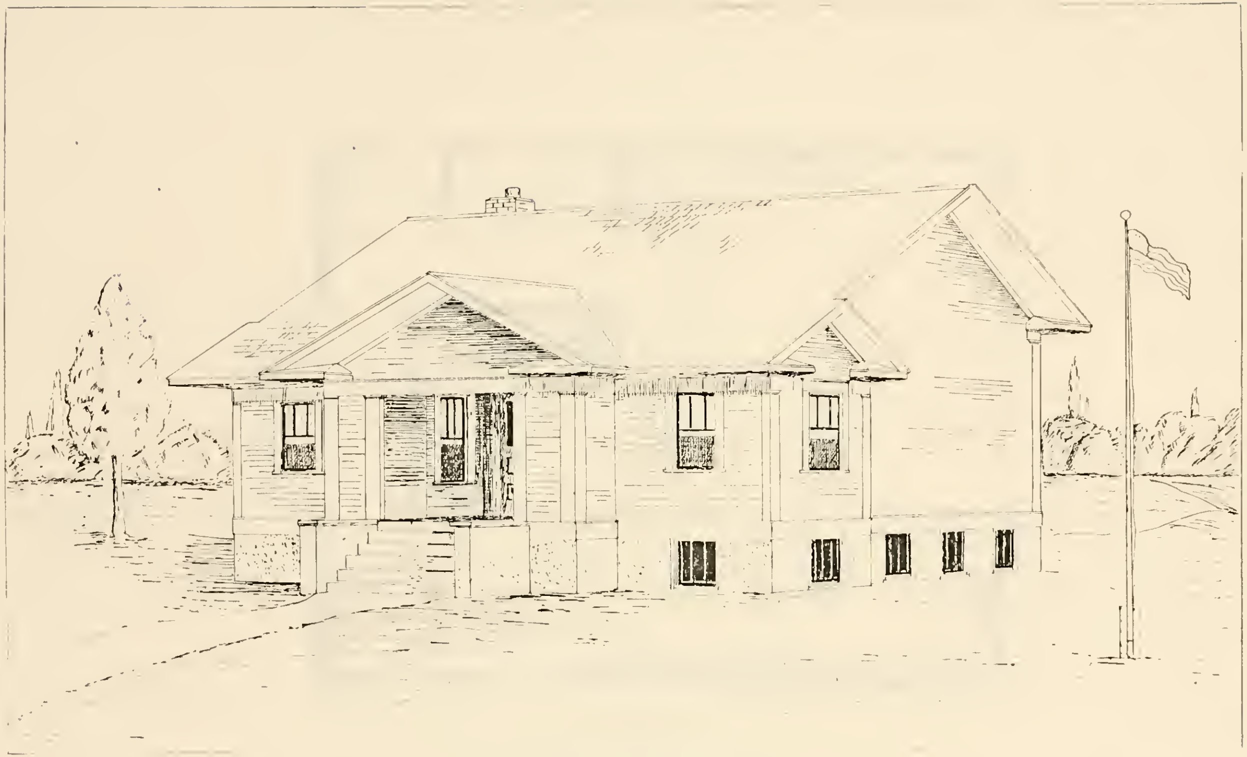
PLAN C4 AND C4B—FIG. 17.



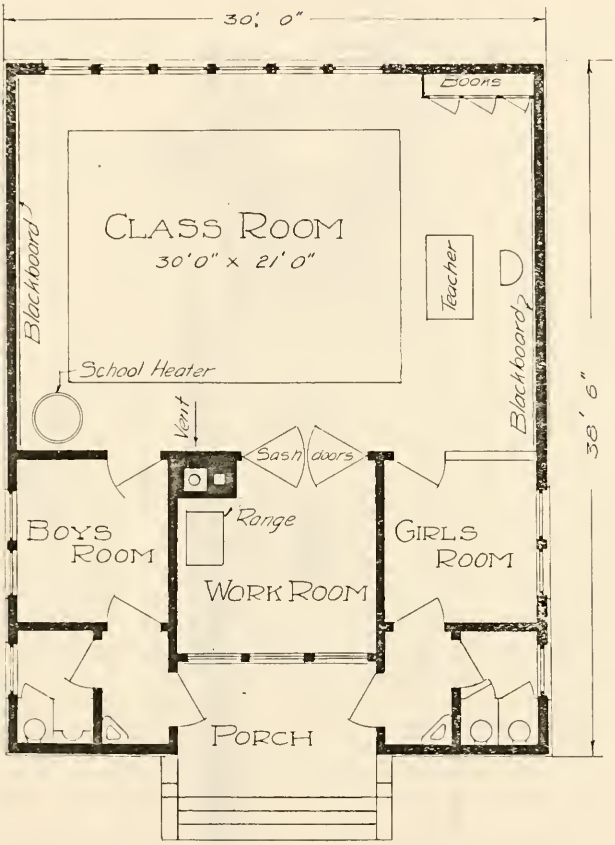
PLAN B3—FIG. 19.



PLAN B3—FIG. 18.

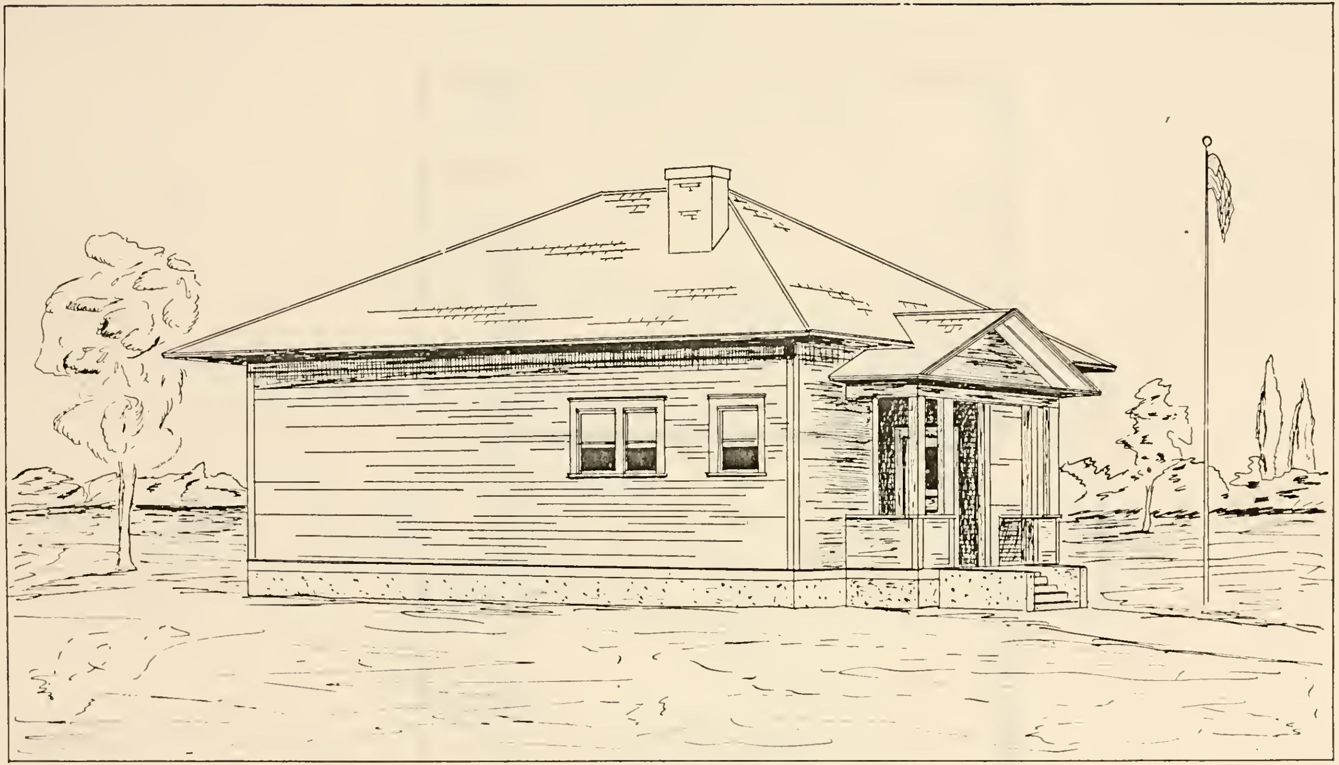


PLAN B3—FIG. 20.

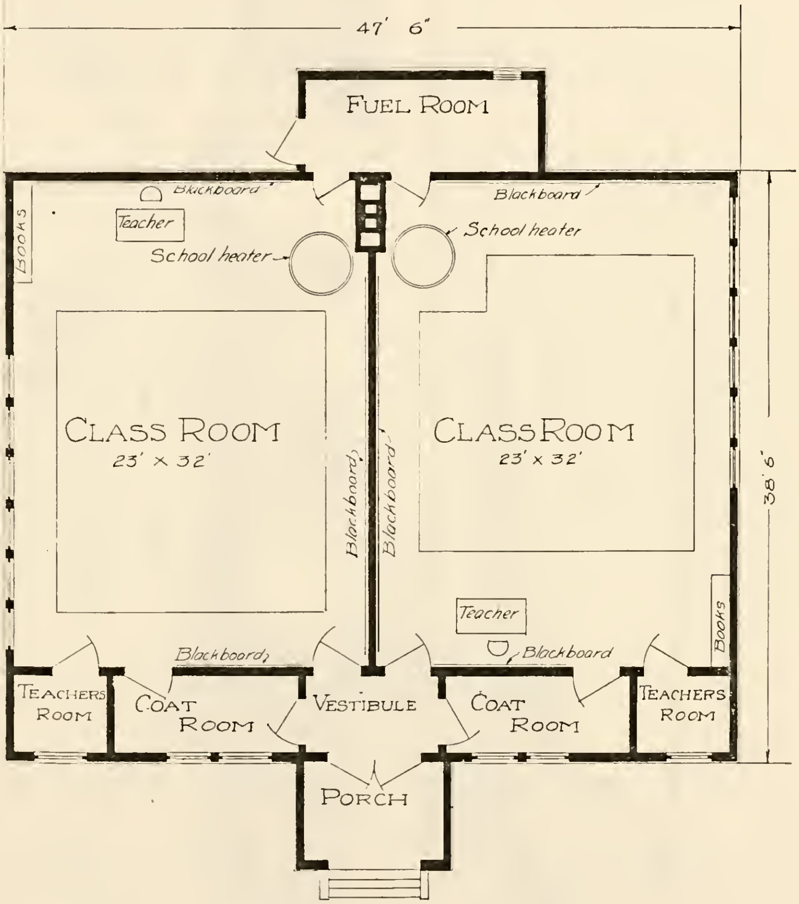


FLOOR PLAN

PLAN A3—FIG. 21.

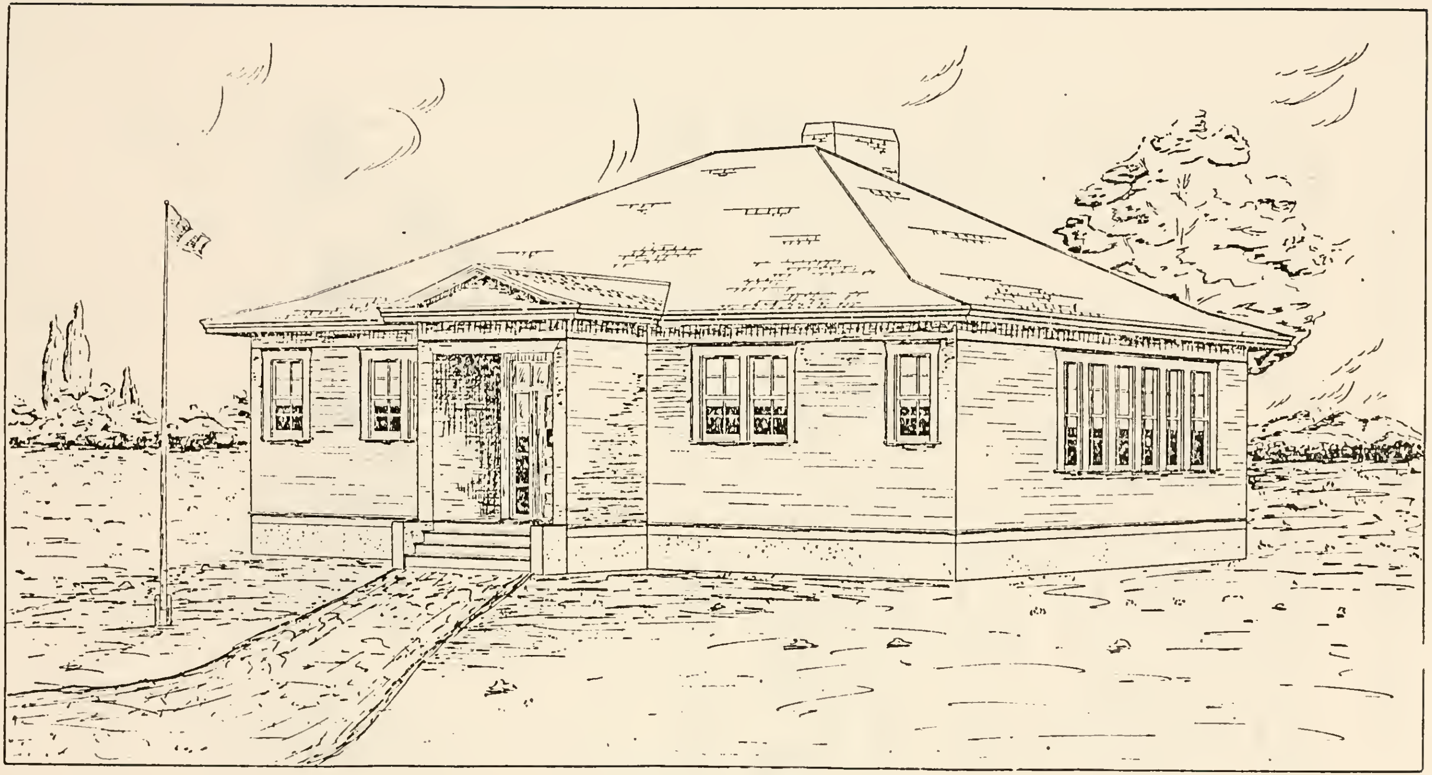


PLAN A3—FIG. 22.



FLOOR PLAN

PLAN A4—FIG. 23.



PLAN A4—FIG. 24.

Plan B2

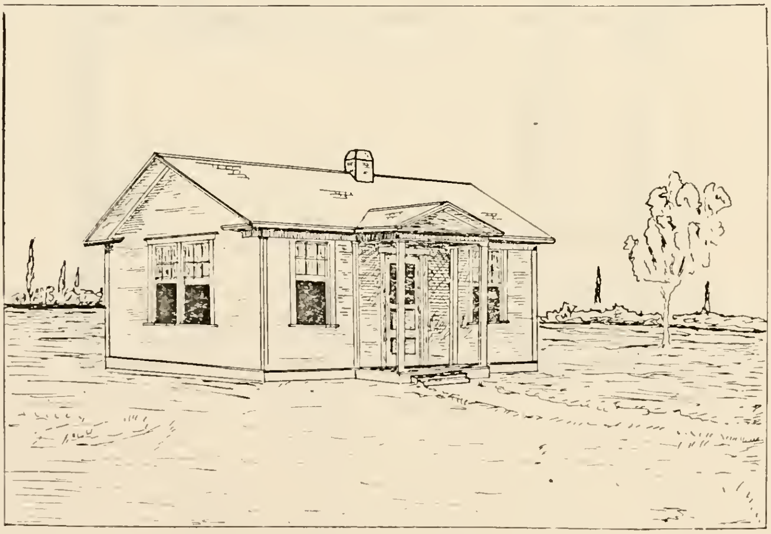
Plan B2 is for use where two rooms are needed for immediate use ,with a possibility of requiring three rooms in the near future. It provides two excellent class rooms, with one coat room each. The library is large and can be of considerable use for committee and board work. It is located so that for a future addition it becomes the hall and another library room must be provided. The basement is large and so arranged that the greater portion of it is available for a play room; the furnace and coal rooms being shut off from this part. The work room is large enough to be of great use in manual training.

If it is desirable the library may be used for domestic science. Since it is adjacent to the chimney a range may be very conviently installed. In this case book cases should be provided in each school room.

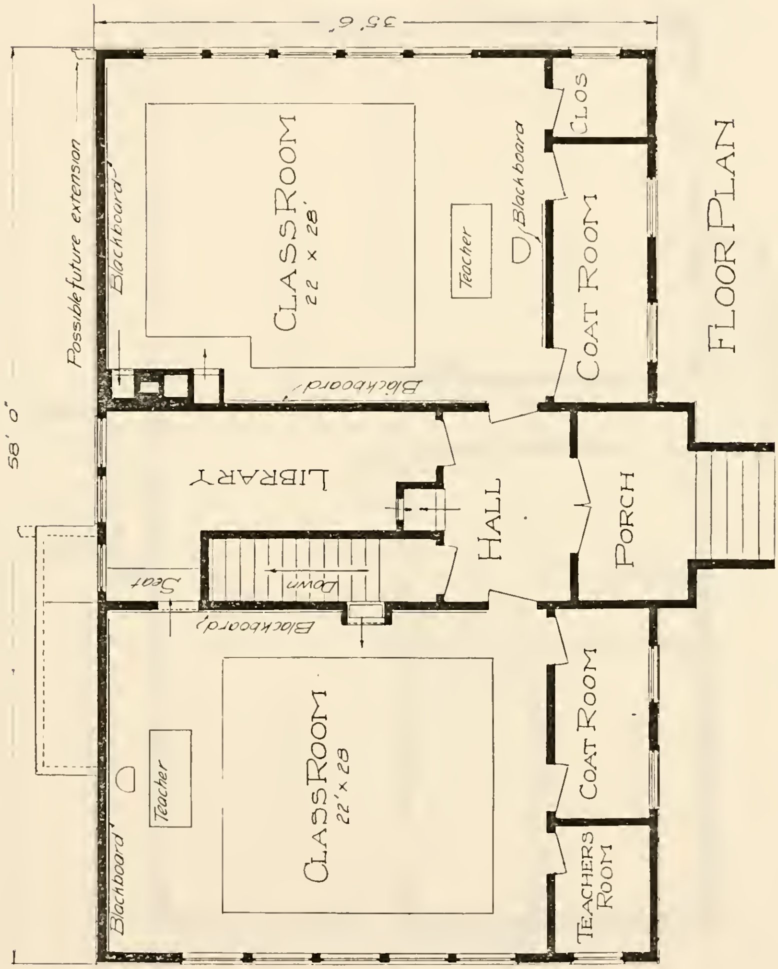
In selecting a furnace consideration should be given to the probability of future extension, and to whether or not it is desirable to heat all with one furnace.

It is probably better, considering the severe requirements made on a furnace in school buildings, to install another furnace if an addition to the layout as shown is made.

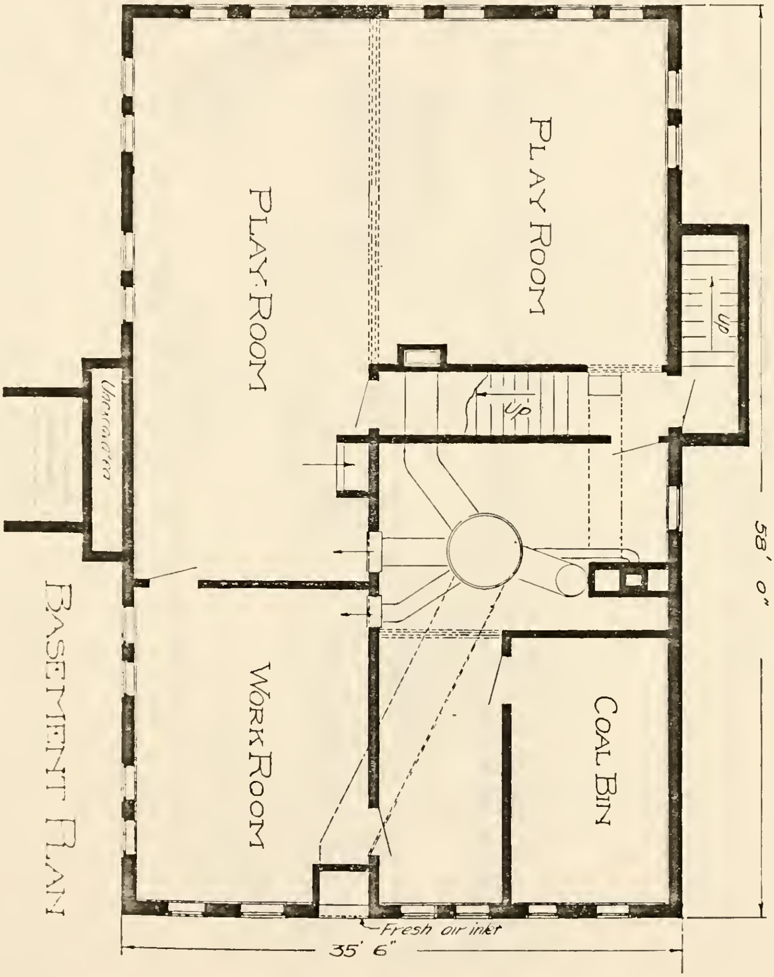
The building is adapted to either a north or a south front, but should not be used for either an east or west front.



PLAN T1—FIG. 25.

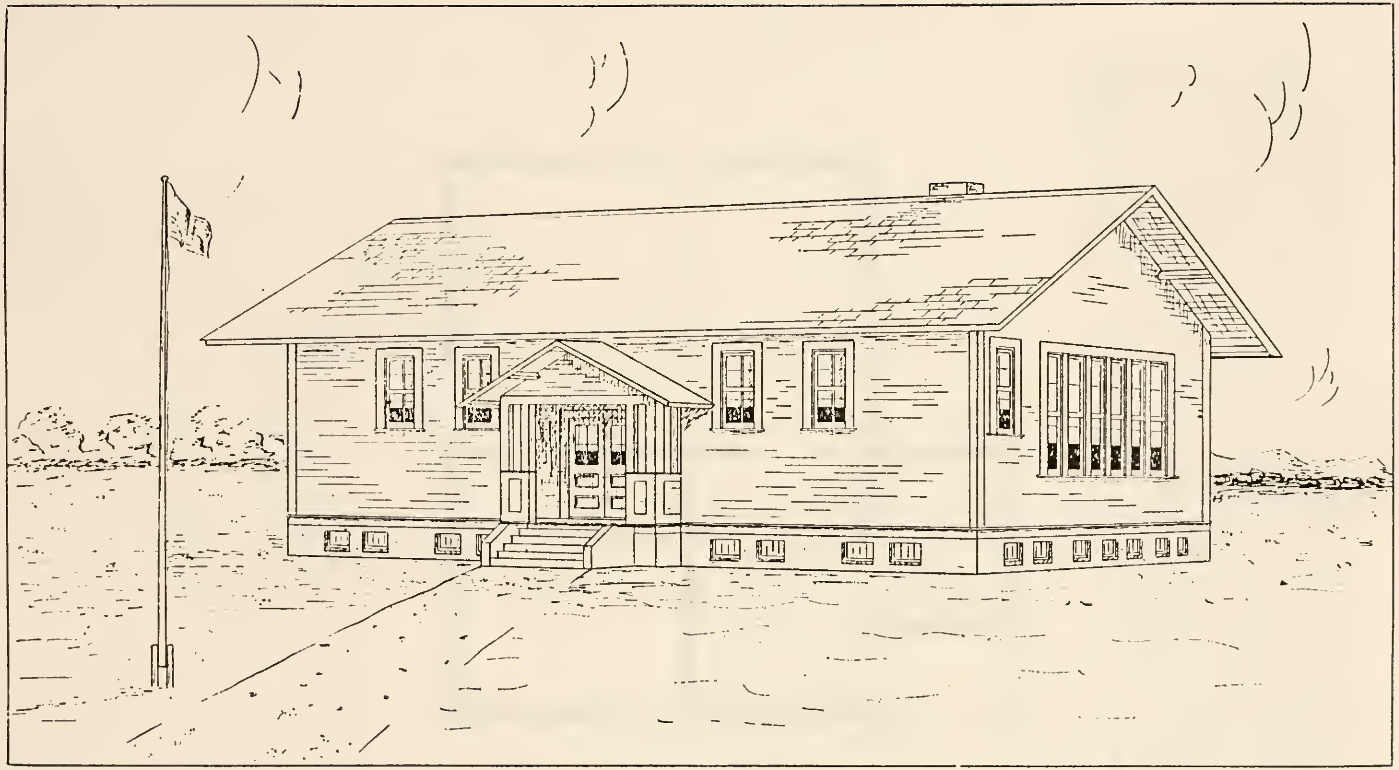


PLAN B2—FIG. 26.



BASEMENT PLAN

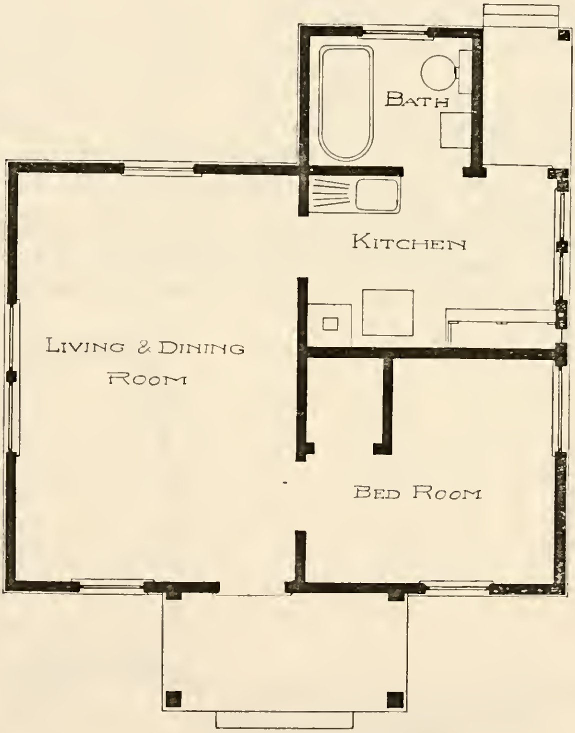
PLAN B2—FIG. 27.



PLAN B2—FIG. 28.

Plan T1

Teacherages. For rural communities in Montana it is sometimes necessary that the district furnish a house for the teacher. For this reason a plan of a small teacherage T1 figures 28 and 29 have been included in the bulletin. If properly built it will be found comfortable and fully adequate for a rural teacher's needs. If it can be so located that water is available, then bath should be included. If, however, it is not possible to have running water or other adequate means of water supply, the bathroom, of course, should be omitted.



PLAN T1—FIG. 29.

WATER SUPPLY.

It is sometimes possible so to locate a school that running water may be provided either by a gravity system or by means of a hydraulic ram and pressure tank. Where at all possible the gravity system will give the more satisfactory service. It requires less room for installation since no pressure tank is needed. It also is as a rule cheaper. These systems are in such general use in Montana that no special description is considered necessary.

Hydraulic Ram. The hydraulic ram is a simple though wasteful machine which utilizes the momentum of a stream of water falling a small height to elevate a portion of the water to a greater height. A complete installation consists of a drive pipe, pneumatic tank and various desirable fixtures with their plumbing. The ram itself consists of an air chamber, dash valve, and body pipe.

The hydraulic ram is usually used to elevate water from a pure spring or stream. Care should be taken to insure the purity of the water in either case. The flow of the spring should not be less than 1 gallon per minute. It is also necessary that there be considerable difference of elevation between the level of the supply and a convenient location for the ram within a reasonable distance. Figure 30 shows a cross section of a simple type of hydraulic ram.

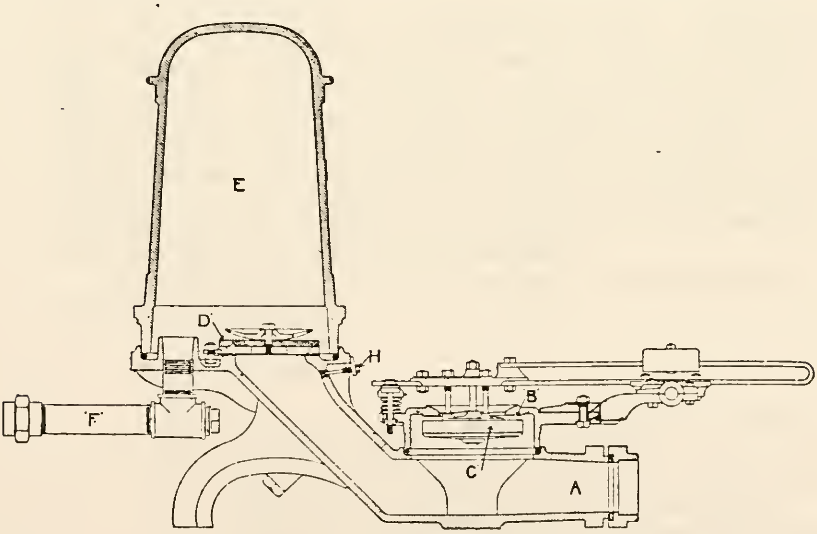


FIG. 30

Referring to Figure 30, suppose that the valve "C" is down so that the water entering from drive pipe 'A" can flow out freely. Under these conditions the water will flow faster and faster. As it does so the pressure on the under side of the valve "C" will gradually increase due to the resistance of the valve. When this pressure becomes sufficient the valve will be lifted quickly to its seat.

At the instant of shutting off, the water is still in rapid motion throughout the "drive pipe" as it is known. This large heavy column of water being suddenly stopped, exerts a great pressure, which serves to force water through the check valve "D" in to chamber "E". The water then rebounds back up the drive pipe until forced down again by its weight, and the operation is repeated.

During each momentary reflow a small quantity of water is forced into the air chamber compressing the air. The resulting air pressure forces water up the delivery pipe to the point of delivery. The operation of a ram is continuous once started, until the valve becomes worn. The ordinary small ram completes a cycle about 60 times per minute.

There is also manufactured a double acting ram whereby impure water may be used to elevate pure water from another source.

Figure 31 shows in a general way the arrangement of a drive pipe, ram, and delivery pipe. There are four separate problems connected wtih the hydraulic ram. They are (1) Given the fall, lift, and the quantity of water desired, find the nessary supply at spring; (2) Given the lift, quantity of water desired, find the fall required; (3) Given the fall, lift, and quantity of driving water find the quantity of water supplied to the storage tank; (4) Given the fall, quantity of drive water, quantity of water desired, find how high this water can be pumped.

All these may be solved by means of the following approximate equation:

$$q = \frac{Q \times H}{h}$$

Q = supply of water in spring in gallons per minute.
H = fall in feet from spring to ram.
h = height of pressure tank above ram plus 2.3 times the pressure required in the tank.
q = quantity of water pumped in gallons which result should be reduced about $\frac{1}{3}$ to allow for friction.

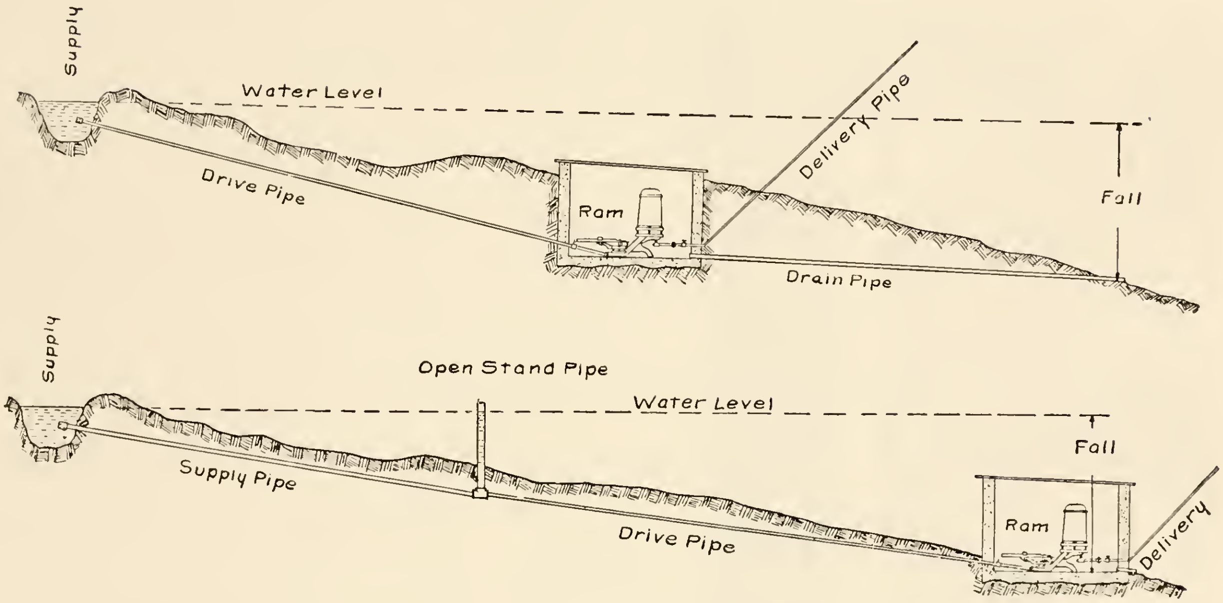


FIG. 31

METHOD OF INSTALLING HYDRAULIC RAM.

If a spring is used it should be walled in to form a reservoir. If a stream is used it should be dammed back until a sufficient flow and fall is obtained.

It is necessary to provide a shelter for the hydraulic ram to prevent freezing in severe weather. The pipes should be placed below the frost line. In setting a ram the foundation should be firm and level. The drive pipe should be laid on a perfectly straight incline without beds or curves except where it enters the ram, and this should be made by bending the pipe. The upper end of the drive pipe should be below the surface of the water to prevent suction—at last a foot. A good open strainer should be provided at the upper end also. Above all things the drive pipe should be air tight.

Manufacturers of hydraulic rams should supply directions for proper installation and they should be followed.

If it is desired to adapt one of the plans in this bulletin to the use of water carriage toilets, drinking fountains, etc., aid may be had if desired, by addressing the State College at Bozeman.

Specifications.

The following specifications are to cover all various designs of frame school buildings shown in this bulletin, entitled "One and Two Room Rural School Buildings", and if construction other than that shown here is desired and approved, additional specifications will be furnished on request.

GENERAL CONDITIONS.

Documents. The contract documents consist of the agreement, these specifications, and the detail drawings furnished by the Montana State College for the particular building contemplated. These documents are complimentary and what is called for by either one shall be as binding as if called for by all. The intent of the documents is to include all labor and materials reasonably necessary for the proper execution of the work. It is not intended, however, that materials and work not covered by or properly inferable from any heading, brands, class or trade of the specification shall be supplied unless distinctly so noted on the drawings. Materials or work described in words which so applied have a well known technical or trade meaning shall be held to refer to such standards.

Drawings. All drawings and specifications reasonably necessary for the completion of the work will be furnished to the contractor free of charge.

Material and Labor. Unless otherwise stipulated the contractor shall provide and pay for all material, and labor, necessary for the execution of the work.

Unless otherwise specified all materials shall be new and both workmanship and material shall be of good quality. The contractor shall, if required, furnish satisfactory evidence as to the kind of material and quality of material.

Inspection. The building may be inspected from time to time by the owner or his authorized representative, as may be needed. Failure on the part of either the inspector or owner to detect or condemn the defective work or material shall not relieve the contractor or his sureties from liability to make it good should it afterward be discovered, or cause damage to the building.

Correction of Work Before Final Payment. The contractor shall promptly remove all work or material called to his attention as not complying with the specifications and promptly replace and re-execute his own work in accordance with the contract and without expense to the owner.

Changes in Work. The owner without invalidating the contract, may make changes by altering, adding to, or deducting from the work, the contract sum being adjustable accordingly. All such work shall be executed under the original contract.

The value of such changes shall be determined by agreement, and shall be made only upon such agreements being written and signed by the contractor and owner.

Claims for Extras. If the Contractor claims that instructions, by drawings or otherwise, involve extra cost under this contract, he shall give the owner written notice thereof, before proceeding to execute the work, in which case the owner and contractor shall each appoint one arbitrator, these arbitrators selecting a third arbitrator, all of whom considering the question shall determine the justice of the contractor's claim. Their decision shall be binding upon either party. In case the claim of the contractor is upheld the procedure shall then be as provided in the last preceding paragraph entitled "Changes in the Work". No such claim for extras shall be valid unless so made.

Protection of Finished Work. The contractor is required to assume all risk from damage or loss by fire or other cause to finished work and material up to the time the building is delivered to and accepted by the owner. He shall use care and protect from the elements all such work so that it will be in perfect condition.

Payments. The payments on this contract are to be made as follows: The first payment, 25% when the building is enclosed; the second payment of 25% when building is sided and plastered; and the third payment of 25% when finished; the final payment of 25% of the cost of the building to be made after it has been completed and accepted by the trustees and inspected by a representative from either the State Board of Health or State Department of Public Instruction. By a ruling of the State Board of Health treasurers are instructed not to make final payment until this clause has been complied with.

Finally. Touch up all work that has been in any way damaged or defaced. Clean all work that may be soiled

in any manner, all paint spots from floors, glass, wall, etc., leaving the premises in first class condition.

Payments Withheld. The owner may withhold or, on account of subsequent discovered evidence, nullify the whole or a part of any certificate or warrant for payment to protect the owner from loss on account of:

(a) Defective work not remedied.
(b) Claims filed or reasonable evidence indicating probable filing of claim;
(c) Failure of the contractor to make payments properly to sub-contractors, for material or labor.
(d) A reasonable doubt that the contract can be completed for the amount then unpaid.

When all the above grounds are removed warrants shall at once be issued for amounts withheld because of them.

Bonds. Contractors presenting bids on the work contemplated are required to accompany their bids with a certified check in the amount of 5% of the bid, and made payable to the Clerk of the Board of Trustees, of the district for which the work is being done. Said check is a guarantee that if awarded the contract, the bidder will appear and enter into the contract promptly for the completion of the building. As soon as the contract is signed and bond delivered, all such checks will be returned except that, if the bidder is awarded the contract and he refuses to sign the agreement and furnish the required bond, his check shall not be returned but held to reimburse said school board against any loss or expense incurred on account of said bidder refusing to complete the contract.

The contractor is required as part of his agreement to furnish a good and sufficient bond in the amount of one-half of the contract price, executed and delivered to said Clerk of the Board of Trustees within fifteen days (15) after being awarded the contract. Said bond is to indemnify the owner against loss under said contract.

MASON'S SPECIFICATIONS.

Laying Out. Set batter boards and lay out the building under the direction of the owner.

Grades. The grades as shown on the drawings are only approximate and were not intended to be suitable for any particular site. Where the contour of the ground requires

a change in grade they shall be established by the owner but in no case must the floor be less than 18 inches from the ground. The price bid shall be on the grade as shown on the drawing.

Excavation Excavate for basement, walls, piers, or footings as shown on the plans which are in general 2 feet below the surface of the ground. Make trench 6 inches wider on each side at bottom than required for wall, bottom to be leveled off and contain no loose dirt.

Concrete Work. Forms for concrete work shall be built above ground and below ground where necessary to complete the construction as contemplated. Use only a high grade well seasoned Portland Cement that has been kept in good condition . The gravel shall be clean and well graded, and shall not contain lime or organic matter to any appreciable amount and no boulder whose greatest dimension is more than one-half the thickness of the wall in which it is to be used. In foundations work the ratio of cement to aggregate shall be between one to seven and one to eight proportioned by volume. The mixing shall be done either by a machine or by hand on a tight platform to the consistency so that when poured it will flow into forms in a jelly-like mass.

All boulders and coarse gravel shall be carefully spaded away from exposed faces so that when the forms are removed no boulder or large stone shall show on the surface.

Forms shall be removed as soon as possible without endangering the wall.

Stone Work. Where cement foundations are shown in the plans stone work may be substituted by permission of the Board of Trustees, in which case use only close grained hard stone of thickness equal to the wall in which it is to be placed. Axe to a rectangular shape and lay in wall on natural bed. Use only cement mortar consisting of one part of some standard brand of Portland cement and three parts of clean sharp sand. Point all joints and finish in a good and workmanlike manner.

Cement Floors. Floors and slabs designated on the plans as concrete and not reinforced shall be four inches thick, of which the top 3/4 inch shall be a wearing surface consisting of one part of Portland Cement and two parts of sharp, well-screened sand trowelled smoth. Porch floors are to be constructed on forms and reinforced as shown on the plan. They shall be treated as above unless otherwise indicated on the drawing.

Concrete Steps. Concrete steps shall be built in forms as called for on the drawings. They shall be of a concrete having one part of Portland Cement to five parts of gravel, containing no large rocks or stones. Filling below the steps shall be of gravel well soaked and settled. Finish neatly with trowelled treads, and copings as shown.

Chimney. The chimney is to be built of the dimensions shown on the plans using only hard burned, common brick laid in level courses with corners plumb and surfaces true. The walls of all heat flues must be 8 inches thick and well plastered from top to bottom inside and where passing through the floor and ceiling, on the outside. Where the plans call for it a metal smoke fule shall be provided and securely fastened inside the chimney with metal stays every three feet. Place thimbles, grating, and cleanouts where shown on the plan. Use a good quality lime mortar from the foundation to the roof, but outside of the roof use a cement mortar containing not more than 25% of well slacked lime. All chimneys are to be topped as shown in the elevation. Where a cement cap is shown it shall be sound and free from crack, well set and seasoned before being placed in position. All chimneys shall start from the ground and rest on a concrete footing at least 10 inches thick and at least 10 inches wider on each side than the corresponding dimension of the chimney.

CARPENTER WORK.

Framing. All framing material shall be seasoned and dry, of the grade and quality specified and have no defects that will tend to affect the strength and durability of the structure.

Sills. Select them for straightness and uniform thickness, bring to a level by bedding in mortar.

Joist. To be of No. 1 common Fir or Larch having no knots in nor within one inch (1″) of the bottom edge. Place crowning edge upward, tow nail securely to all sills upon which they rest.

Bridging. Cross bridging to be made of sound stuff (2″ x 2″) two by two inches, well fitted and put in as soon as the joists are leveled. It shall be spiked with two (2) ten penny nails at each end. Number or runs of bridging are usually specified on detail drawings, but when not otherwise specified, spans greater than 10 feet shall be bridged.

Studding. Studding should be of No. 1 common fir, or

larch, or native. All studding shall bear directly on sills or plates below the building wall. Tow nail studding thoroughly at bottom in all cases. Double studding around all openings, and in case of doors, the double stud shall continue from bottom to top. Double or triple studding at the corners and spike all double studs together.

Partitions. Double all joist along partitions running parallel to them, separate them so that the floor will be supported and may be nailed with the base shoe to them. Use double plate above and single plate below in all partions.

Plates. Double all top plates and select them for straightness, spike together thoroughly, breaking joints by at least three feet.

Rafters. Use No. 1 common fir or larch, crowning edge upward, accurately framed according to details and thoroughly nailed.

Sheeting. Use ship lap No. 2 common or better, nail to every stud or joist diagonally everywhere except on roof.

Paper. Use threaded tar building felt over all sheeting and see that it extends well up into all window sills, and is well lapped at corners. Place behind all cornice, and corner board, and window frames when setting, leaving plenty to lap. See that paper extends downward to the sill.

Window Frames. All windows must be of form, style, and dimensions marked on the plans in elevation, sections and details. Pully styles of banked class room windows to be of 1⅛ inch stock and wedged top and bottom after setting.

Door Frames. All door frames shall be of one and one quarter inch clear stock, rabbeted.

Outside Trim. All outside trim shall be white pine grade "C", or better quality, securely nailed with casing nails of proper size.

Siding. Side wtih first quality cedar or white pine siding 6 inches wide laid 4 inches to the weather, unless otherwise specified on detailed plans. Cut close joint against all casings, brackets, jambs, etc., and properly nailed with 6 penny box nails every 16 inches.

Roof. Use Star-A-Star, 6:2 shingles nailed with two 3d. galvanized shingle nails to each shingle two inches in

width or over. Layon roof four and one-half (4½) inches to the weather using care that they are not laid so tight that they will buckle when wet.

Flashing. Flash roof to chimney and sides to porch with good grade flashing tin shingles painted both sides when laid. Give the outside a second coat after laying. Use galvanized iron for gutters and hip shingles.

Sash. All sash shall be of pine or spruce one and three eighths inches thick. All double hung sash shall have a one inch meeting rail, two inch style, bored and ploughed for sash cord ,three inch bottom rails; hang with Silver Lake sash cord and cast iron weights to balance.

Equip all moveable sash with sash lift and fastener.

Doors. All doors shall be 5 cross panel O. G. sticking, AA quality, 1¾ inch thickness for all 3′-0″ by 7′-0″ or larger, and 1⅜ inch thickness for all smaller doors. On doors 3′-0″ by 7′-0″ or larger use three 4 inches by 4 inches butts, smaller doors may be hung with two 4 inches by 4 inches butts. Use mortice locks on all doors.

Floors. All floors to be double consisting of a subfloor of eight or ten inch shiplap laid diagonally and nailed with 3 nails to each joist, and covered with 30 pound Red Rosin sized building paper well lapped. On this shall be placed one by four (1x4) No. 1 vertical grained tongue and grooved fir flooring. It shall be a tight driving fit, and that which joins up loosely shall be rejected. All floors shall be blind nailed after being driven tight, casing nails of proper size being used throughout and set with the side of the nail set. Class room floors shall be smoothed to a reasonably finished surface.

Interior Finish. Material for interior finish will be clear slash grained fir, free from checks or blemishes of any description, and in such shape that it can be treated with stain and result in a first class job in every particular. All finish shall be properly cleaned, sanded and smoothed, and securely put in place and held by finish nails of proper size, all countersunk. All uncased plastered corners shall be protected with corner beads. Put up base knobs where necessary. No finish shall be put in place till plaster is thoroughly dry.

Picture Moulding. Place a picture mold of plain design around all class rooms. Mould shall be securely fastened

18 inches from ceiling by nails in each studding.

Coat Rooms. Coat rooms shall be provided with two rows of brass finish cast iron hooks mounted two feet apart on suitable strips, one strip to be placed 4 feet from the floor and another 5 feet from the floor in such a manner that the hooks will be one foot apart in alternate rows, these strips are to extend entirely around sides and back of coat rooms. The top strip shall be on brackets extending out 6 inches from the wall.

Coal Bin. Coal bins shall be double sheeted inside with 8 inch shiplap laid diagonally ,the second course running opposite to the first and lined between with 30 pound Red Rosin building paper.

Closets. All closets shall be provided with shelves as shown on detail drawings.

Blackboards. Hylo-Plate, Acme, or any other equally good composition blackboards shall be placed where shown on the plans. They shall be provided with chalk rail of the detail shown, unless fixtures furnished by the manufacturer is used.

Hardware. Finish and place all hardware for doors, windows, cupboards, etc., including nails, screws, and other small hardware necessary to complete the job in good and substantial manner. All doors 3′-0″ by 7′-0″ or larger shall be hung with 3 four inch by four inch butts, smaller doors may have but 2 butts. All locks shall be mortice locks. The finish for all knobs, escutcheons and sash lifts shall be the Bower-Barff finish. Outside front door to be equipped with Yale and Towne or Corbin paracentric front door lock. Other outside doors shall have the thumb turn in lock, and no key.

Storm Sash. Equip all class room windows with storm windows of 1⅛ inch stock. Where outside trim is ⅞ inch they shall be rabbeted to ⅞ inch so they will bear against the blind stop. They shall be divided in such a way that there will be no bar in the storm window not opposite the meeting rail or muntin in the main window. Hang from the top with a good form of storm window hanger and provide with some substantial make of adjustable storm window fastener.

Grounds. Put up grounds for finish of all windows, doors, bases, casings ,etc., before plastering.

LATH AND PLASTER.

Lath. Use No. 1 pine lath free from knots, bark and cross grain. Green native lath are preferred. Wet thoroughly before placing on wall. Break joints every sixth course and nail to each bearing. Place lath 3/8 inch on ceiling and very little closer on walls. No lathing through the angles allowed.

Plaster. Plaster two coats with some standard brand of gypsum or patented hard wall plaster in accordance with the printed directions of the manufacturer. The finish coat shall consist of the above mentioned plaster having the hair or fibre screened out. It shall be finished with a float finish. Finish all outside concrete work with a coat of cement plaster of one part of Portland cement to one and one-half parts clean, screened sand. Trowel the cement plaster well into the concrete surface, which has been kept thoroughly wet for 1/2 day before applying the plaster. Finish the same down with a carpeted float, and keep moist for three or four days.

PAINTING.

Outside. For all outside painting use only standard brands of White Lead and strictly pure linseed oil. Colors as directed by the owner. Putty all nail holes and allowable dents, shellac all knots and sappy places wtih pure gum shellac before applying paint. Prime all exterior finish including siding as soon as possible after being placed, finish with three coats.

Interior. Stain all wood work in class rooms, coat rooms, and other rooms except coal room with a green oil stain—Bog Oak—Weathered Oak—after which apply a coat of orange shellac; sand lightly and apply one coat of a good interior varnish, sand again and finish with one coat of Pratt and Lambert's Dulkote, or Standard Varnish Company's Flatine.

Walls. Calcimine all walls with some standard hot water paint, using a light greenish gray tint for side walls. Considerable care is required not to get too much green. The ceiling should be treated in the same manner with a tint somewhat lighter but of the same general tone.

HEATING.

School Heaters. Where school heaters are specified on the plans they shall be of some standard ventilating

form meeting the approval of the State Board of Health, installed according to the direction furnished by the manufacturer.

Furnace. Where furnace heat is specified on the plan it shall consist of any standard hot air furnace, set in the manner indicated on the floor and basement plans. The inside casing shall be corrugated tin, the outside casing No. 26 guage galvanized iron. The drafts shall be arranged for control from the class room, and all provided with necessary ducts and leaders of size shown. Equip all vents and inlets with louvre dampers, operated from class room. Cover all hot air pipes with asbestos or some other recognized form of insulation.

FLAG POLE.

Furnish and place in position as desired by the owner a flag pole not less than thirty feet high. It shall be straight and if made from native sapling, shall be peeled and trimmed in a neat manner. Before raising equip top with pulley well secured to pole by means of an eye bolt, and thread with halyard of ¼ inch cotton rope. Also equip the top with a six inch wood ball. Fasten the pole in a vertical position with two ½ inch bolts between two 6 inch by 6 inch posts which have been set into the ground until they are sufficiently rigid. If the pole is built of timber it shall be finished at an even taper from 6 inches at the bottom to 2½ inches at the top.

Finish pole and posts with two coats of white lead and oil paint. Finish ball with some good outside bronze paint.

HOW TO PROCEED IN BUILDING.

After having studied the bulletin and perhaps after corresponding with the State Superintendent of Public Instruction, decide on what design will best meet your needs, fill out one of the applications in the back of this bulletin and forward with one dollar, to the Superintendent of Public Instruction. This deposit is in no sense a charge for plans, but is only intended to act as a bar to those writing out of pure curiosity. In case the plans are used in building the deposit will be returned, or if they are not so used but are returned in good condition the deposit will be returned.

After having received the plans, and having made provision for funds, proceed to advertise for two weeks for bids in some paper published in the County. The advertisement may be in some such form as the following:

NOTICE TO CONTRACTORS.

Sealed proposals will be received by the Board of Trustees of School district No. ...., ...County, Montana, at ....up to ....o'clock ....M., on the ....day of ....191......... for furnishing materials and constructing a school building for said School District, plans for which are on file at ....

Proposals must be addressed to the Clerk of the Board of Trustees of School District No. ...., ...Montana, and must contain a certified check or its equivalent, made payable to said clerk, in an amount equal to five (5) per cent of the amount of the bid.

Plans and specifications may be seen and blank forms for proposals procured from the Clerk of the Board of Trustees of said District.

The right is reserved to reject any and all bids.

....Chairman.

....Clerk.

Before the day of letting the Clerk should have typewritten several blanks for proposals and furnish them to prospective bidders. The form may be as follows:

PROPOSAL.

To the Board of Trustees, School District No....................

....County, Montana.

Gentlemen:—

The undersigned proposes to do all the work, furnish all the materials, in accordance with the printed form and the contracts and specifications on file, and bind...on acceptance of this proposal, to enter into and execute a contract in the form of said specifications, and contract for the execution of such work at the price named below, towit: .... Dollars ($....................)

Enclosed is a certified check for ....Dollars ($..................), which sum is to be forfeited to the Board of Trustees of School District No. ...., ... County, Montana, if the party or parties making this proposal fail to enter into contract, with approved securities, within fifteen (15) days after the contract is awarded to said party or parties respectively.

Signed...

Contractor.

....

Address:

....

....

Promptly at the time of letting the trustees should meet in regular session for the purpose of opening the bids. After the bids are opened the successful bidder should be notified, and informed that within fifteen (15) days he is required to complete his contract by filing a Bond and signing an Agreement. These documents are furnished with the Detail Plans and the Specifications.

After the Bond and Agreement have been signed the certified check of all bidders will be returned to them.

Payments should be made when and only as prescribed in the paragraph on Payments in the Specifications.

Some districts hesitate to let a contract but seek to avoid the law by various means. This is in general not satisfactory or economical. When no contract is let there is always an element of uncertainty and indefiniteness about the proceedure that is wasteful. When endeavoring to get a better building by rendering voluntary aid much better results are had by making such aid definite in time and amount and so to state it in the contract and Instructions to Bidders. If it is desired to raise money by bonding, a pamphlet explaining the proceedure may be had by writing to the State Superintendent of Public Instruction.

REMODELING OLD BUILDINGS.

Old buildings may frequently be remodeled to give better light and better facilities without any great expenditure of money, and in cases where it is not feasible to build a new building, the Department of Architectural Engineering at the State College at Bozeman, is willing, when possible, to assist in remodeling the old ones. Such assistance may consist of advice or plans, after studying the case by correspondence, or when necessary, of visiting the district and working out a remodeling scheme.

When it is desirable that some one visit the district, it is necessary in order to conserve time, to make the request some time in advance so that in the event of several requests all the visits may be made on one trip.

There are no funds available for this purpose, and each district will be required to bear its part of the railroad fare and expenses of the person making the visit.

Sewage Disposal for Rural Schools and the Rural School Privy.

by

F. C. SNOW,

Consulting Sanitary Engineer, State Board of Health.

The disposal of waste products from the body which collect in quantities sufficient to cause quite a problem in rural communities and especially around the country school houses where a number of children congregate each day for a part of the year at least, demands the use of the most sanitary methods available, mainly on account of health, but also on account of convenience.

The two essentials of any process that has for its object the disposal of human excreta are:

1. That all the excreta must be removed without delay to a place where it can be permanently disposed of, and,

2. That it must be permanently disposed of in such a way as to lose its power for evil.

The best and surest way of constructing a plant that will satisfy these essential conditions by using sewer pipe carriers so constructed and connected with a pressure system of water supply that all the excreta is carried in flowing water to a disposal plant, consisting of a preliminary liquification in a septic tank, followed by a final process of treatment in some form of a system of underground or sub-irrigation tile.

For the benefit of the few rural schools that are equipped with a pressure system of water supply this system of disposal will be explained. The toilets can be placed in the basement of the school house and connected by a six inch sewer to a septic tank. A four inch cast iron vent pipe should also be carried to the roof of the building from the connection of the toilets with the sewer pipe to prevent the impure air from the sewer from entering the building.

After flowing into the septic tank the solid or organic matter in the sewage undergoes a change. The forces of decay are constantly at work on organic matter of every

kind, causing sooner or later its complete reduction or liquification. Confined in a tank and kept reasonably quiet, especially at the surface, sewage in a few weeks becomes covered with a thick scum, and the solid matter settles out and forms a deposit of sludge in the bottom of the tank. The particles of organic matter are continually rising from the sludge and more or less gas is evolved. Throughout the entire action bacteria are at work liquifying the organic matter and the action is very effective, so complete in fact that comparatively little sediment forms in the tank even after long periods of operation without cleaning.

Description of Septic Tank. Figure 32 shows a section of a septic tank, for liquification, and a siphon chamber and siphon for discharging the septic effluent in large intermittent doses into the following sub-irrigation system. The sewage enters the tank (A) through the inlet pipe (E), which is the end of the house sewer. Here it is subjected to the liquifying action of the bacteria in the tank after which it passes over the weir (D) into the siphon chamber (B). From here it is discharged by the siphon. The septic tank proper, or the part marked (A) Fig. 32 should be four feet wide, six feet long and five feet deep. The depth of the liquid in the tank should be four feet. The lower inside line of the inlet pipe (E) should be one foot below the lower edge of the tank roof and this pipe should be turned downward with an elbow for the discharge of the incoming sewage below the surface of the liquid in the tank. The bottom and walls of the tank should be seven inches thick if constructed of concrete composed of one part cement to three parts sand to five parts of crushed rock, or a mixture of about one part cement to five parts of natural gravel if the latter is used. The top should be six inches thick and reinforced with any standard mesh reinforcement, or one fourth inch steel rods or strands of barbed wire, spaced three inches apart and one inch from the bottom of the slab and running both lengthwise and across the tank. A manhole should be left for cleaning. A cover (G) for this may be made of concrete poured into the hole with tapered and notched sides as shown, previously left in the roof when the latter was poured. Before pouring this cover the sides of the hole should be well greased or covered with oiled paper so that the concrete of the cover will not form a bond with that of the sides of the hole. An iron handle should be built into this cover also.

The baffles (C) (C) can be made of wood. They are

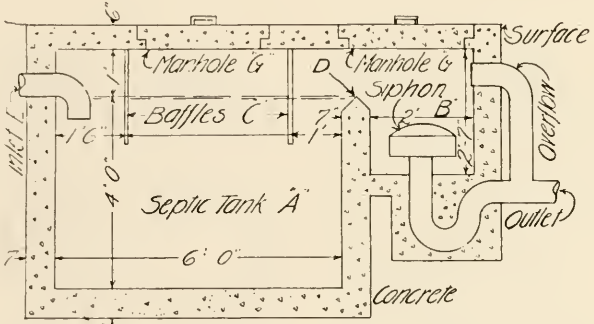


FIG 32

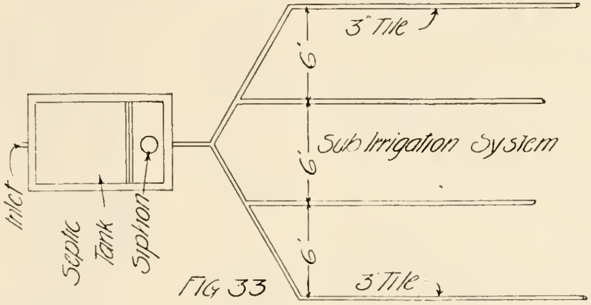
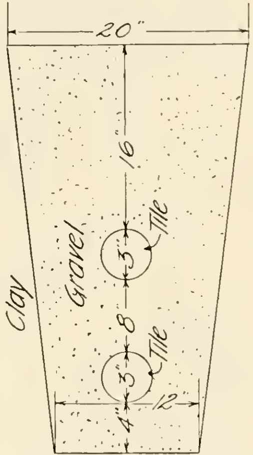
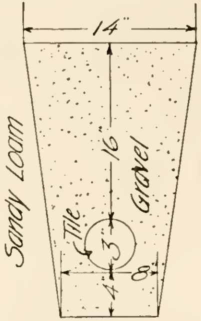


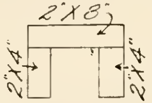
FIG 33



Filter Absorption System
FIG 36



Sub-Irrigation System
FIG 34



Open base wood box drain
FIG 35

for the purpose of reducing the disturbance caused by inflowing sewage and to hold the surface scum within the tank. The one at the entrance is spaced one and one-half feet from the inside of the wall of the tank and the other about a foot from the edge of the outlet weir. They should extend into the liquid about one foot. The top of the outlet weir (D) is sharp and one foot below the inside top of the tank. This extends entirely across the tank and its upper edge is level so that the escaping liquid flows over it in a thin sheet without causing any disturbance in the tank proper.

Siphon Chamber. The Siphon Chamber (B) Fig. 32 should be built as a continuation of the tank and should have a manhole with a removable cover built as explained in the preceeding paragraph. This chamber should be three feet wide, two feet seven inches deep and two feet long, inside dimensions. The liquid enters the siphon chamber over the weir (D). This chamber simply retains the more or less irregular discharges from the septic tank until a certain quantity is collected, when it is very rapidly discharged by the siphon.

This siphon can be bought from the Pacific Flush Tank Co., Chicago, or from the Hendrie & Bolthoff Mfg. Co., Denver, Colo.

After this discharge is completed the siphon prevents a second discharge until the chamber is filled again. Such distribution is necessary for the reason that if the liquid is allowed to pass into the final absorption system in the same irregular way that it leaves the toilets, the tiles and surrounding materials will be constantly saturated near their upper ends but no effluent will reach their lower ends. The best results are obtained when the drains are filled quickly by a dose as from a siphon, and this quantity is allowed to percolate into the soil slowly and the drains become filled with air, before another dose is applied.

Final Treatment. The septic process should be followed by some form of final purification process. Septic action simply changes the solid organic matters in the sewage to liquids and these liquids must be further treated to avoid all danger to health.

Sub-Irrigation Systems for Final Treatment. From the siphon chamber of the septic tank the effluent flows into a system of four inch open jointed drains about 300 feet in length laid from two or three feet below the surface of the ground. A good arrangement of these tile drains is to

lay the tile in six parallel rows about fifty feet long and between six and ten feet of space between the rows. These rows of drains are connected across their upper end by a cross line of tile, and this line connects with the siphon outlet as shown in Fig. 32. The manner of laying these tile is shown in Figs. 33 and 34. Instead of tile, wooden box drains, built of two, two by fours and one, two by eight pieces of lumber and open at the bottom as shown in Fig. 35 may be used if desired.

While a system of sub-irrigation drains frequently works for years without any trouble, yet it will occasionally become clogged and require cleaning.

The area where the sub-irrigation system is installed should be selected at a place where the ground water level is the lowest, which will generally be on a bench at the tpo of a slope. Of course the relative elevation of the ground surface should be low enough to insure sufficient fall from the siphon outlet to the tiling.

The soil should be of a gravelly formation if possible or at least not impervious to the flow of water and the area should be so located as to prevent contamination of any wells or springs which may exist, that is, the area should be below the well location and as far removed from the same as possible. The flow of underground water should in all cases be from the well to the sub-irrigation area not from this area to the well.

Filter Absorption System of Final Purification. When the soil of the sub-irrigation area is impervious, the septic tank fluid will not percolate into it from the subdrains and it becomes necessary to build a filter system. This is done by placing a second system of tile about a foot under the first system of drains. These also have open joints and are connected to some outlet, such as a creek. Both the sub-irrigation tiles and the second system of drain tiles are laid in the same trenches which are then filled with sand or gravel as shown in Fig. 36.

Systems Where a Water Supply Under Pressure is Not Available. As practically all the rural school houses have no pressure system of water supply, the methods of disposing of human excreta, explained above will be of no value, and it becomes necessary to minimize, as far as possible, the dangers which lurk in the careless handling and improper disposal of the waste of the human system.

Under the most primitive conditions excreta is deposited directly upon the earth. A slight advance over this condition is found in the common privy wtih its accompany-

ing pit for the collection of excreta. This is a most objectionable contrivance. Quantities of decomposing and noxious excreta are stored up in a more or less porous pit or even in a mass directly on the surface of the ground, freely exposed to the distributing agency of flies. The liquids leach into the surrounding soil and if the solid matter is removed at all, the handling causes a menace to health. Such a system is out of the question for a rural school and under no circumstances should it be allowed.

The Dry System. The dry system privy consists of a container of some sort that is water tight, placed under the seat and a box of dry soil, ashes or lime in which is a scoop holding about one half of a pint. Each time the closet is used the excreta is to be covered with the dry deodorizer from the supply box. If this is carefully done and the container is emptied often such a system is an excellent one. The difficulty, however, is that this is not done, especially where this system is used for schools and the contents of the container soon become noxious. This system, on this account cannot be considered a good one for the rural schools.

L. R. S. Privy. The form of toilet known as the L. R. S. privy and invented by Drs. Lumsden, Roberts and Stiles of the United States Public Health Service, a modification of which is shown in Fig. 37, is an excellent one for use at Rural Schools.. Its action is one and the same as the septic tank in connection with the sub-irrigation system of drains.

This style of privy consists of a concrete tank five feet by eight feet in section and six feet deep, placed under the entire floor of the building. An outlet pipe, three feet from the bottom carries the effluent to the underdrain system, which should consist of about one hundred and fifty feet of three inch open joint tile laid about three feet under ground. The reason for having the tank so deep and three feet of space above the liquid is to prevent freezing.

This tank should be filled with water when put into service and if evaporation is very great the liquid will in time become very thick. Whenever this occurs more water should be added. As the action is the same as in the septic tank, the solid matter gradually liquifies and the effluent flows into the tile sub-drains and is disposed of by seeping into the surrounding gravel. If this type of privy is managed fairly intelligently the indications are that the tank will rarely need cleaning, probably not oftener than once in several years. Only the regular thin toilet paper should

be used in these privies as it is easily decomposed.

The location usually selected for this style of privy is at the rear corner of the school lot. They should not, however, be placed a great distance from the school house so as not to be convenient and easily accessible to the children in cold weather. The state law requires two independent buildings.

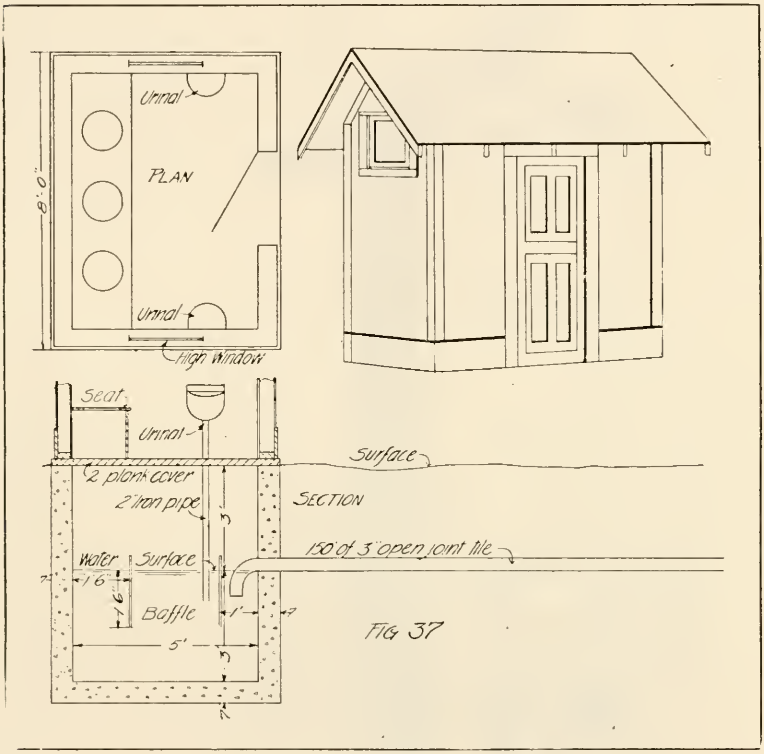


FIG 37

Screens of timber or possibly vines can be used to hide the buildings, but in Montana during the greater part of the school year it is too cold for vines to grow and a hedge of evergreens would probably form a better screen, not only as far as appearence is concerned but as a protection against the weather when the children are compelled to use these buildings.

Chemical Closets. Recently a form of chemical closet has been placed on the market consisting of an underground tank which contains a powerful disinfectant in liquid form,

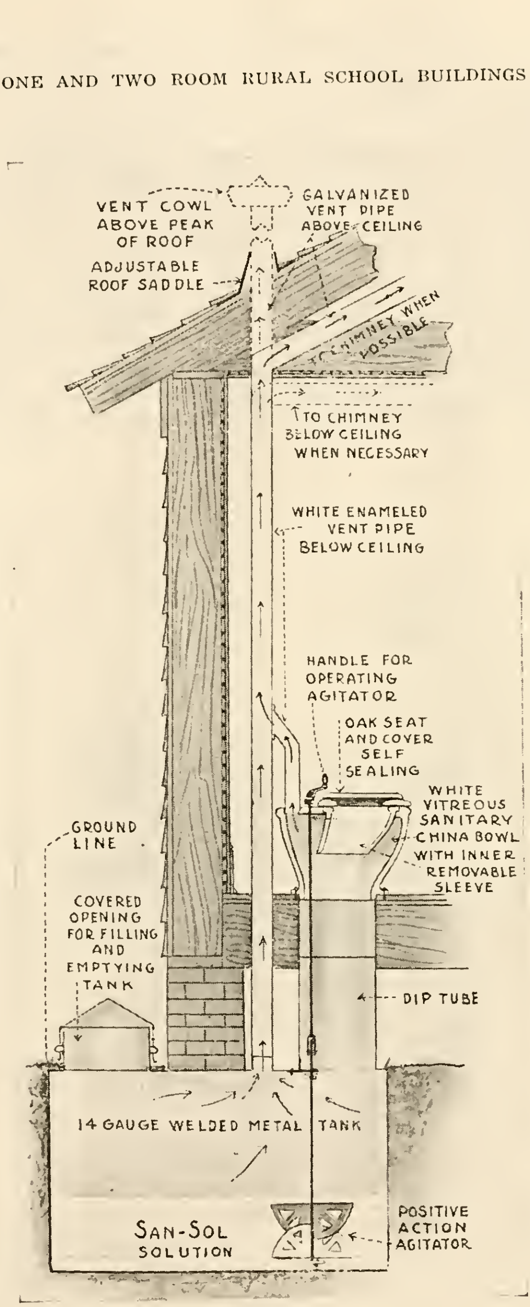

VENT COWL ABOVE PEAK OF ROOF
GALVANIZED VENT PIPE ABOVE CEILING
ADJUSTABLE ROOF SADDLE
TO CHIMNEY WHEN POSSIBLE
TO CHIMNEY BELOW CEILING WHEN NECESSARY
WHITE ENAMELED VENT PIPE BELOW CEILING
HANDLE FOR OPERATING AGITATOR
OAK SEAT AND COVER SELF SEALING
WHITE VITREOUS SANITARY CHINA BOWL WITH INNER REMOVABLE SLEEVE
GROUND LINE
COVERED OPENING FOR FILLING AND EMPTYING TANK
DIP TUBE
14 GAUGE WELDED METAL TANK
SAN-SOL SOLUTION
POSITIVE ACTION AGITATOR

FIG. 38.

and a seat can be placed on the inside of the school house. At intervals the tank is emptied from the outside of the building and again filled with disinfectant.

A great many of these closets are in use. They are cheap and easily installed and are much better than the old style of outdoor privy. One difficulty with these toilets is the fact that the pipe leading from the seat to the tank becomes noxious, due to the deposits of facel matter which sticks to its sides. This trouble can be controlled, however, by a careful cleaning with a long handled stiff, scrubbing brush and water at least once a week. The amount of water used must be small or the underground tank will soon become filled up and require emptying often. See Fig. 38.

APPLICATION FOR PLANS.

Secretary State Board of Health,
Helena, Montana.

Please send plans for Design No......... Enclosed is $1.00 as a deposit guaranteeing that they will be returned in good order if not used in building. The Trustees agree to make no changes in the plans or specifications without the consent of the Secretary of State Board of Health.

Building proposed for District No. ...., County of .... Enrolment of School .... Assessed valuation of District .... Present Indebtedness............................. Present buildings ....

Names of Trustees ....

Name of Clerk ....

Address ....

Name of Teacher ....

Name of Applicant ....

P. O. Address ....

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